Ref. 621.305
Shelved w. 058

ELECTRICAL REVIEW

[ILLUSTRATED]

A WEEKLY JOURNAL OF

ELECTRIC LIGHT, TELEPHONE TELEGRAPH AND SCIENTIFIC PROGRESS.

(Formerly Review of Telegraph and Telephone.)

Vol. 5, No. 1. WEEKLY. | NEW YORK, SATURDAY, SEPTEMBER 6, 1884. | $3 per annum. Single Copies, 10 Cents

ST. LOUIS PUBLIC LIBRARY JAN 21 1943

Copyright, 1883, by DELANO & COMPANY, 23 Park Row, New York.

Entered at Post Office, New York, as Mail Matter of the Second Class.

An Extraordinary Experiment in Synchronous-Multiplex Telegraphy.

BY PROF. EDWIN J. HOUSTON.

A most extraordinary experiment, which is not devoid of practical bearings, has quite recently been made by Mr. Patrick B. Delany with his synchronous-multiplex telegraphic system, which is now in operation between Boston and Providence, a distance of about fifty miles.

As the experiment about to be described almost challenges belief in its possibility, I deire to state that I have seen it myself and can vouch for the accuracy of the facts herein stated.

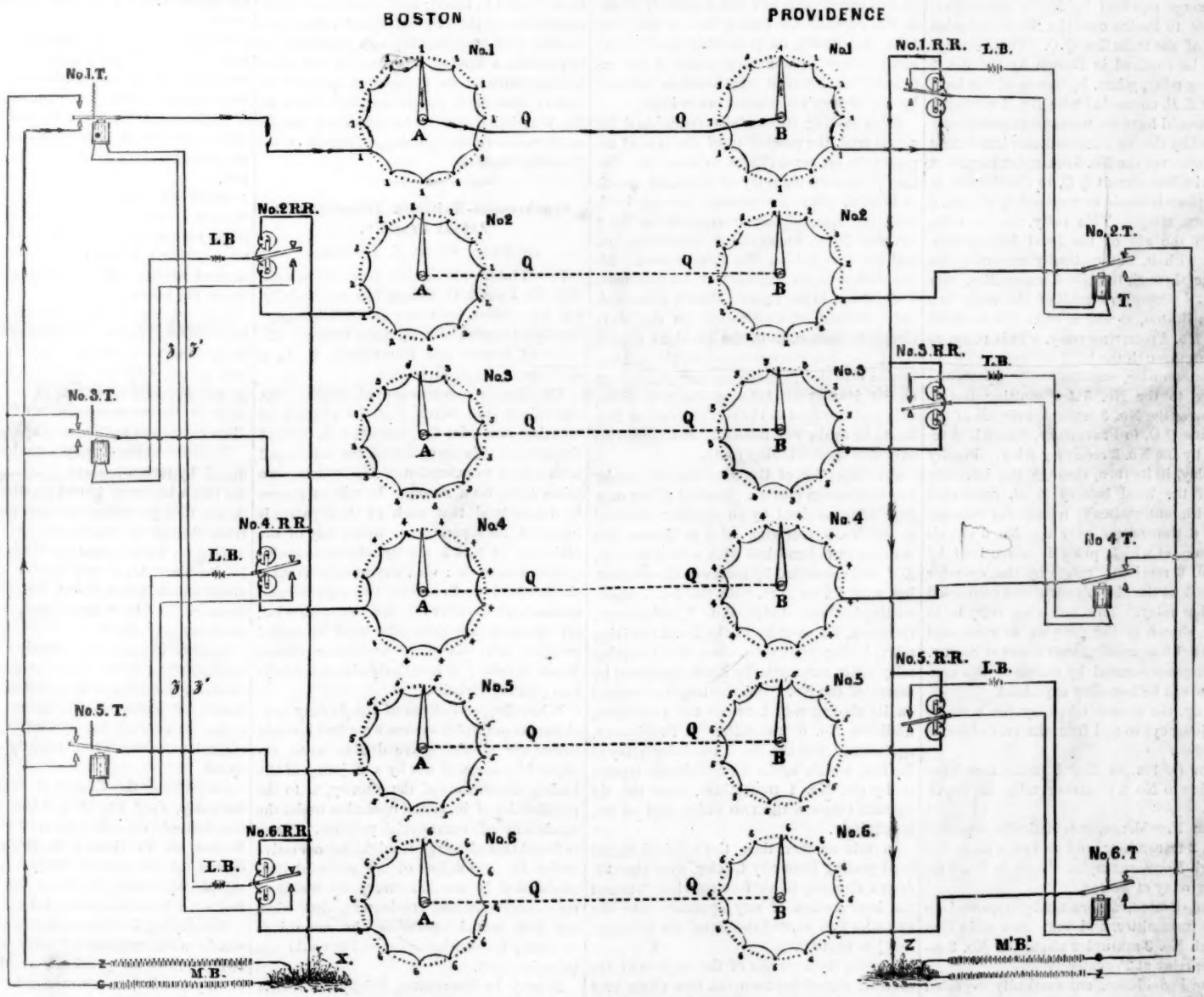
Wishing to try the adaptability to the synchronous system, of the automatic repeaters employed by other telegraphic systems, whereby great distances are overcome, Mr. Delany, on three different occasions during the past two weeks, successfully employed such repeaters with his system, the last trial, viz., that on Monday the 14th of July, being witnessed by myself.

One of the two wires erected by the Multiplex Company between Boston and Providence, was divided into six separate and distinct Morse circuits. The first of these circuits, which we will call No. 1, was operated to Providence, at which place the receiving relay, on that circuit, was connected to the transmitting instrument on No. 2 circuit. In Boston the receiving relay of No. 2 circuit was connected to the transmitting instrument of No. 3 circuit. In Providence the receiving relay of No 3 circuit was connected to the transmitting instrument of No. 4 circuit. In Boston, the receiving instrument of No. 4 circuit was connected to the transmitting instrument of No. 5 circuit. Finally, in Providence, the receiving relay or instrument, of No. 5 circuit, was connected to the transmitting instrument of No. 6 circuit.

Under these arrangements, the transmitting instruments at both stations were operated by the receiving relays on the other circuit, the same as if worked or operated by an operator; in other words, the six separate and distinct circuits, established by the synchronizing apparatus between Boston and Providence, were arranged so as to form in reality a continuous wire stretched six times between Boston and Providence, with both of its free ends in Boston.

Mr. Delany then transmitted a message on the No. 1 circuit, from Boston to Providence, which was automatically retransmitted from Providence to Boston on No. 2 circuit; again automatically retransmitted from Boston to Providence on No. 3 circuit; again automatically retransmitted from Providence to Boston on No. 4 circuit; again automatically retransmitted from Boston to Providence on No. 5 circuit, and finally automatically retransmitted from Providence to Boston on No. 6 circuit. Or, in other words, the message sent from Boston on the first circuit went to Providence, came back to Boston, again went to Providence and came back to Boston, when it again went to Providence and came back to Boston, at which final station it was clearly read by an operator without the loss of a single character, or the slightest impairing of its original clearness, and without the aid of any person except the transmitting operator on the No. 1 circuit in Boston, and the receiving operator on the No. 6 circuit in Boston. All this was done over one and the same wire, so that the message traveled in its back and forth journeys between the two cities about three hundred miles, or six times the distance between the two cities.

A reference to the drawing will render the preceding explanation clearer. The synchronized distributing instruments, *A* and *B*, situated at Boston and Providence, respectively, are connected by the single main line *Q Q*. The line is divided into six circuits, which we will call respectively No. 1



AN EXTRAORDINARY EXPERIMENT IN SYNCHRONOUS-MULTIPLEX TELEGRAPHY.

2, 3, 4, 5 and 6. For the purpose of rendering the connections clearer, these six circuits have been separately represented with the synchronized distributing instruments connected therewith. It will of course be understood that but a single main line *Q Q*, furnished with but two distributing instruments, viz., one, *A*, at Boston, and the other, *B*, at Providence, exists between the two cities.

This being premised, an inspection of the drawing will show that the main battery *M B*, of Boston, split and grounded at *X*, is connected with the No. 1, No. 3 and No. 5 transmitters, which are respectively connected with the No. 1, No. 3 and No. 5 sextuplex circuits of the single main line *Q Q*. At Providence the main battery, M^1 B^1, split and grounded at *Z*, is connected with the No. 2, No. 4 and No. 6 transmitters, which are respectively connected with the No. 2, No. 4 and No. 6 sextuplex circuits of the single main line *Q Q*.

At Providence the No. 1 receiver is connected with the transmitter of No. 2 circuit, so that a message sent from Boston by No. 1 transmitter would be received by the No. 1 receiving relay in Providence, when, by means of the local battery *L B*, would have its message repeated by No. 2 transmitter, and sent to Boston over the No. 2 sextuplex circuit of the main line *Q Q*. This message would be received in Boston by the No. 2 receiving relay, when, by means of the local battery *L B*, connected with No. 2 receiving relay, would have its message automatically repeated by the No. 3 transmitting instrument at Boston, over the No. 3 sextuplex circuit of the main line circuit *Q Q*, to Providence, at which place it would be received by the No. 3 receiving relay. This relay, in its turn, through the aid of the local battery connected with it, automatically transmits the message through the No. 4 transmitter, over the No. 4 sextuplex circuit of the main line *Q Q*, to Boston, at which place it is received by the No. 4 receiving relay. This relay, in its turn, through the local battery *L B*, connected therewith, automatically repeats the message to the No. 5 transmitting instrument, over the No. 5 sextuplex circuit of the main line *Q Q*, to Providence, where it is received by the No. 5 receiving relay. Finally this relay, in its turn, through the intervention of the local battery *L B*, connected therewith, automatically repeats the message to No. 6 transmitter, over the No. 6 circuit to Boston, at which place it is received by the No. 6 receiving relay, by the operator stationed at the Morse instrument connected with that relay. This receiving relay is, in reality, shown in the drawing as connected with No. 1 transmitting instrument at Boston. The purposes secured by means of this connection will be hereafter explained.

Briefly, the course taken by the message in its journeys to and from the two cities, is as follows:

From Boston, by No. 1 transmitter over main line to No. 1 receiving relay at Providence.

From Providence, automatically repeated to No. 2 transmitter, and sent over main line through No. 2, sextuplex circuit to No. 2 receiving relay at Boston.

From Boston, automatically repeated to No. 3 transmitter, and sent over main line through No. 3 sextuplex circuit to No. 3 receiving relay at Providence.

From Providence, automatically repeated to No. 4 transmitter, and sent over main line through No. 4 sextuplex circuit to No. 4 receiving relay at Boston.

From Boston, automatically repeated to No. 5 transmitter, and sent over main line through No. 5 sextuplex circuit to No. 5 receiving relay at Providence.

Finally, from Providence, automatically repeated to No. 6 transmitter over the main line through No. 6 sextuplex circuit to the No. 6 receiving instrument at Boston, where it is received by the operator.

It is not necessary, as might be supposed from the drawing, that the characters received on the group of segments comprising No. 1 circuit must necessarily begin to return on the next adjoining segment of No. 2 circuit. Suppose, for example, that a character concluded on the segments of No. 1 circuit, where the trailing contact indicates on the drawing. By the time the armature of the relay has moved in response to this character, and has placed No. 2 circuit in connection with the battery for return transmission, the trailing contact may be on the second or third contact of the No. 2 circuit. This, however, will make no difference, since both the distributing arms are synchronous, so long as the rotating arms pass over two or three of the No. 2 segments, while the armature of the transmitting magnet is in contact with either of the poles of the battery.

When we consider that a message made up of many words, each word containing numerous letters, each letter consisting of numerous separate and distinct characters, and each character, under the synchronous-multiplex system, consisting of numerous impulses, was transmitted with certainty over a single wire, back and forth, this number of times, without the slightest interruption the one with the other, the fact almost challenges belief.

While these results may appear almost incredible, what I am about to describe may at first thought seem impossible. I will endeavor, however, to give such a description of this experiment as I saw it actually made, as will persuade the reader, that so far from being impossible, its possibility must necessarily follow as a natural result of the exquisitely maintained synchronism secured by Mr. Delany's ingenious inventions.

After having successfully established by actual trial, the possibility of the use of repeaters in his synchronous system, Mr. Delany connected the relay of the sixth circuit in Boston, where the message was received, with the transmitting instrument on No. 1 circuit. Now, under these conditions, on making one dot on No. 1 instrument, this dot started on its zigzag way, to and from Providence, in the manner already described, only, instead of terminating on the sixth circuit in Boston, as in the previous experiment, the same dot was automatically retransmitted into the first circuit, and again sent on its journeying between the two cities, only on its arrival at the sixth circuit in Boston to be again automatically re-transmitted over this same winding route.

An inspection of the drawing will render this connection clearer. Instead of the message being received by an operator stationed at the No. 6 receiving relay at Boston, this instrument is furnished with a local battery, *L B*, and connected by means of the conducting wire *z z*, an z^1 z^1, with the No. 1 transmitting instrument at Boston. By this means, therefore, the operator at the No. 6 receiving relay, is dispensed with, since this receiving relay again automatically sends the signal by means of the No. 1 transmitting instrument on its zig-zag way between the two cities, until the No. 6 transmitter at Providence, again sends it to the No. 6 receiving relay at Boston, which again automatically repeats it by the No. 1 transmitter, over the six circuits between the two cities, and so on, indefinitely.

In this manner, then, the original signal kept passing from city to city, over the different circuits, in perfect rotation, without the intervention of any operator, save the one who first started the signal on its ceaseless journeyings.

Timing the intervals of the returns of the original signal between the two cities over the sextuplex circuits, it was observed that it traveled between Boston and Providence over these six circuits 300 times; or covered the distance between Boston and Providence 1,800 times in each minute, thus making an entire distance of 1,500 miles a second, or 90,000 miles a minute; or for five minutes that a dot was kept going, the original signal, in that short time traveled no less than 450,000 miles, or eighteen times as far as the entire distance around the world at the equator.

Of course it will be understood that most of this time was taken up by the automatic movements of the armatures of the receiving relays, and the levers of the transmitting instruments. The experimental figures so obtained, however, furnish interesting data as to the rapidity, precision, and certainty with which these masses of matter may be influenced by the electric current.

An observer, noticing the progress of this experiment, and reflecting on the numerous complex conditions requisite for its successful accomplishment, cannot but be singularly impressed by its extreme weirdness. Bearing in mind the exceeding complexity of structure of the synchronous-multiplex message, and the necessity for maintaining practically absolute synchronism between the distributing and receiving instruments at each end of the main line, a feeling of incredulity almost unconsciously arises in the listener's mind. Surely this weird traveler must miss some of his numerous connections, and, once missed, his journeys are at an end forever. But when the signals are heard recurring with their automatic regularity, as though tossed to and fro between the cities by a mighty juggler; when they are heard as mysterious whisperings in the air, that follow too rapidly on one another to permit more than a part to be intelligently received, we almost lose sight of the actual conditions of the experiment, and begin to vaguely doubt whether Mr. Delany has not received a visit from Puck, who is bewildered by the rapidity with which he is forced to travel; and when the strange repetitions of the original signal follow one another with such rapidity and regularity as to produce a kind of a prolonged, but mysterious murmur we are almost disposed to believe that these sounds are the plaints of the Wandering Jew, as he ceaselessly speeds on his never-ending journey.—*Journal of the Franklin Institute.*

Synchronous-Multiplex Telegraphy in Actual Practice.

BY PROF. EDWIN J. HOUSTON.

It will interest the public generally to learn that Mr. Patrick B. Delany has successfully put into active operation his synchronous-multiplex system of telegraphy between the cities of Boston and Providence, R. I., a distance of about fifty miles.

The line is constructed of number six galvanized iron wire. For the purpose of securing one wire for operation in case of the accidental interruption of the other, and with a view to extension of the system, two wires have been strung. It will of course be understood that each of these wires is intended for separate use under any of the divisions of which the synchronous-multi-system is capable ; viz., any number from a single circuit up to seventy-two separate and distinct circuits over one and the same wire; or, as these are generally used in actual practice, into six fast, or twelve slower Morse circuits ; or into thirty-six, or seventy-two printing circuits.

When the possibilities of the Delany synchronous-multiplex system were first brought before the public, grave doubts were expressed by some, if not by a majority of the leading electricians of the country, as to the possibilities of its actual operation under the conditions of commercial practice. Many believed that although it might be operative under the conditions of an artificial line, established in the laboratory by means of resistance coils and condensers, that when put into actual operation the conditions necessary for continuous working could not be maintained.

It may be interesting, briefly to review some of the many objections that at the outset were urged against the practical workings of the system. As is, of course, understood, the possibility of the successful operation of the synchronous-multiplex system is dependent on the continuance of the synchronous rotation of the distributing wheel at the transmitting and receiving ends of the line. In Mr. Delany's system, as the reader will probably recall, the synchronous rotation of the discs at each end of the line is maintained by timed, electrical impulses, thrown into electro-magnetic motor devices, by the vibration of similar tuning forks placed one at each end of the line. Now it was urged, and perpaps with some show of reason, that although it might be possible to maintain the synchronous vibration of these forks in a room, where any necessary adjustment of their rate of vibration could be made by an attendant, yet it would clearly be impossible to maintain such synchronous vibration at stations widely separated from each other, since the mere difference of temperature at the two stations would, unless automatically compensated for, be sufficient to throw the two forks out of synchronism.

Another difficulty that in the opinion of many presented an insuperable obstacle to the practical application of the system was the static charge of the line. It was thought that the line could not in practice be discharged with sufficient rapidity to permit the transference thereon of the numerous, separate and distinct electrical impulses necessary in the system. It was feared that before the line could be freed from the charge given it by one impulse, another would be sent over it by the distributor, and that these two would necessarily interfere with each other.

These, and many other difficulties, were urged as necessarily fatal to the success of the system. It is to the credit of Mr. Delany that he has so ingeniously met and overcome all these difficulties, and has established his invention on a commercial basis. But let the actual facts of the case speak for themselves.

Dividing one of the wires between Boston and Providence into six separate circuits, it was worked for long periods at the rate of forty words per minute on each of the circuits so established. Dividing the line into twelve Morse circuits, it was similarly worked at the rate of twenty words per minute on each line.

Thirty-six printing circuits have been worked between the two cities at the rate of from four to five words per minute; while seventy-two printing circuits were similarly worked at the rate of from two to three words per minute.

The circuits above referred to have all been operated in one and the same direction at the same time, or have been operated one-half in one direction and the remaining half in the opposite direction, or other combinations of the same number of separate and distinct circuits have been employed.

In order to practically note the effect produced by increasing the length of the line, the two wires were joined together at Providence, thus providing one continuous circuit from Boston to Providence and back again to Boston, with separate grounds at each end in Boston. Over this double distance of about one hundred miles, the circuits were operated, as above mentioned, without any diminution of speed.

Further experiments introducing artificial resistances of 3,000 ohms, or an equivalent of about 300 miles of line, and of 2½ microfarads of static charge, demonstrated the entire success of the system, under these conditions, with only a slightly diminished speed.

Employing the line as a sextuplex, on Saturday, July 12, 1884, 1,000 words were transmitted over one of the sextuplex circuits, Boston *via* Providence to Boston, and received, at the rate of thirty five words per minute, by sound, by Morse operators, who had never seen the system before that week.

Employing the line as a duodeciplex, 1,100 words were transmitted over one of the twelve lines so provided, at the rate of twenty words per minute, and perfectly received by sound. An increase in the resistance of the line of 9,000 ohms, in addition to the normal resistance of the 100 miles of wire, in the two wires joined as one, did not affect the synchronism, or prevent the perfect transmission of the messages.

The synchronous-multiplex system of telegraphy has now been in actual operation between Boston and Providence, under the various conditions above mentioned, during the last thirty days. During that entire time the synchronism has been maintained between the Boston and the Providence instruments without ten minutes' interruption, excepting, of course, when the instruments were purposely stopped, or were interrupted for the purposes of experiment, or were disturbed by crosses or breaks in the wires of

JAN 11 1943

the main line. When thrown out of synchronism by any of these causes, the instruments at the end of the lines, in all cases, came automatically into synchronism within one and a half minutes, without the intervention of the operator at either the Boston or the Providence end of the line.

Mr. Delany has availed himself of the opportunity which the additional line afforded him of trying, practically, things for which he believed his system adapted, and for which he originally intended it. One of the many purposes to which he showed the applicability of the synchronous-multiplex system would seem to add so greatly to its commercial value, when in actual operation, that it may be well to explain it at length.

Connecting at Providence one of the sextuplex circuits, established in one of the wires, to the end of the second wire at Providence, a message transmitted from Boston over the sextuplex circuit, so connected, was received in Boston on the second wire clearly and perfectly transmitted.

This experiment would seem to show that the synchronous-multiplex system is applicable not only to the connection of terminal stations, whereby the wire may be divided into the numerous circuits claimed for it, but that the six circuits, for example, obtained from a single wire, may be connected at the terminal stations at the two ends of the main line, where a distributing instrument is situated, by independent wires so as to reach the outlying cities beyond. In this manner each of these cities will be furnished with an exclusive circuit through the divided wire.

With, for example, a distributor in New York, connected by a single wire with one in Boston, and divided into, say, six Morse circuits, a single wire, extending to Providence, could be connected at Boston to the No. 1, of the six multiplex circuits, while Lowell could be connected to the No. 2, of the multiplex circuits; Portsmouth to the No. 3, of the multiplex circuits; Worcester to the No. 4, of the multiplex circuits; Lawrence to the No. 5, of the multiplex circuits; and finally Lynn to the No. 6, of the multiplex circuits, thus affording each of these six cities circuits over one and the same wire to New York, through the medium of the distributor at Boston, without any repetition of the dispatches.

In like manner, if so desired, six cities adjacent to New York, within distances of, say, from 75 to 100 miles from New York, might be connected with Boston, through the medium of the New York distributor, or the outlying cities themselves might be put into communication with each other.

Under the present system of telegraphic communication, nearly all these outlying cities are compelled to send their messages on to Boston or New York, from which places they are repeated to their destination.

The connection above referred may be better understood by reference to the figure. *A* and *B* represent the synchronized distributors situated at Boston and Providence, respectively, and connected with the main line wire *Q Q*. The second wire Q^1 Q^1, which ordinarily has no connection with the distributors *A* and *B*, is, for the purposes of this experiment, connected in the manner shown. In the figure the contacts are connected in groups of six, or, in other words, the main line *Q Q* is divided into a sextuplex. The trailing arms, at *A* and *B*, are shown in contact with one of the No. 6, contacts at *d* and *h*, respectively. Polarized relays *R*, R^1, R^2, R^3 and R^4 are connected respectively to five of the six circuits so provided. The sixth circuit in this case, it will be observed, is left unconnected to the polarized relay R^5. The relays are connected by means of switches *S*, S^1, S^2, S^3, S^4 and S^5 with the keys *K*, K^1, K^2, K^3, K^4 and K^5, whose front and back stops are connected with the split battery *M B*, grounded at *Y*. It will also be observed that the polarized relays *R*, etc., can be connected with the keys, or with the ground at *X*, and can therefore be used either for transmitting or receiving.

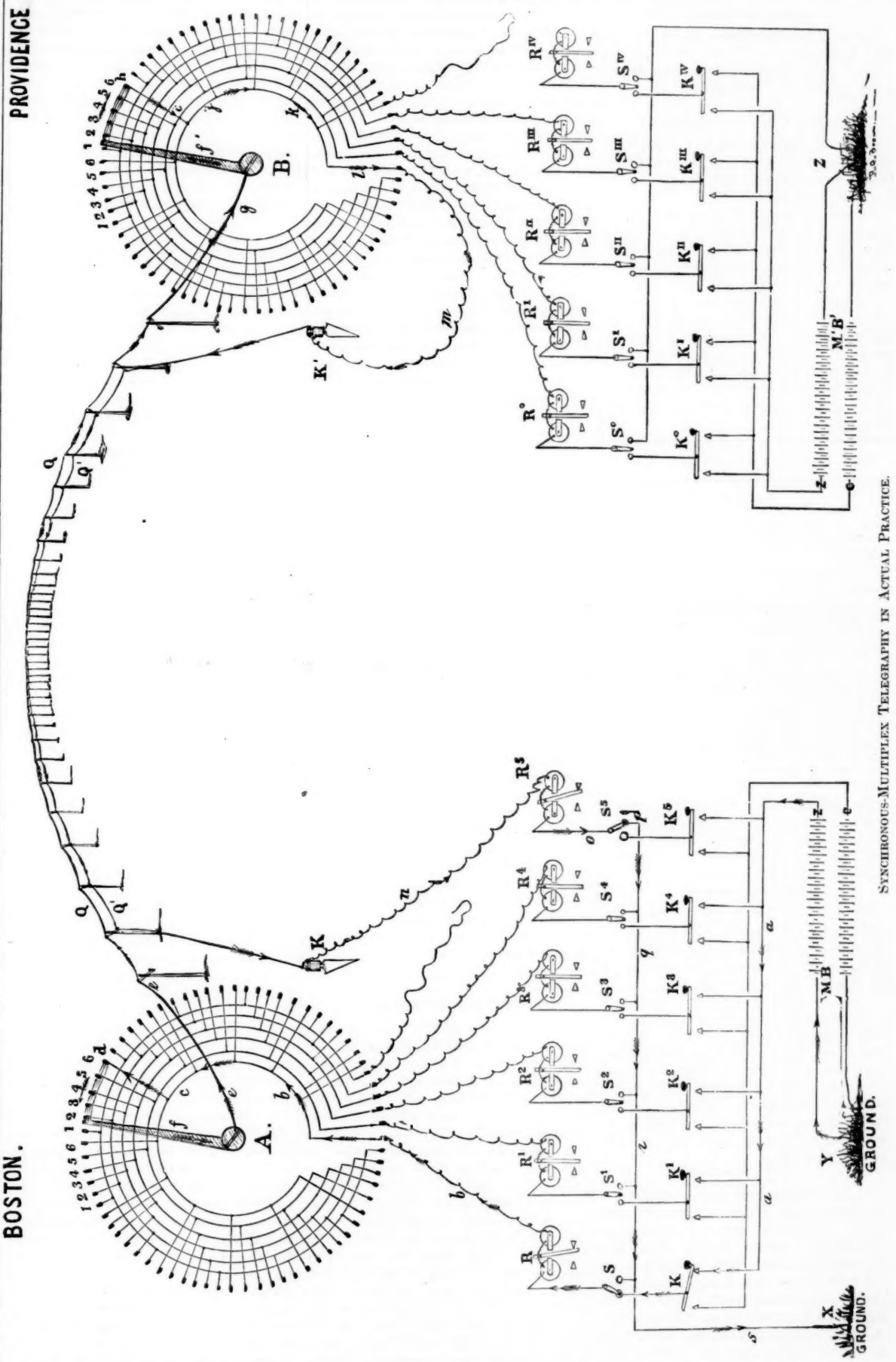
The station at Providence is similarly provided with the polarized relays R^o, R_i, R^{ii}, R^{iii}, and R^{iv}, switches S_o, S^i, S^{ii}, S^{iii}, and S^{iv}, keys K^o, K^i, K^{ii}, K^{iii}, and K^{iv}, and main battery M^1 B^1, split and grounded at *Z*, and all connected as shown.

If, now, the circuits being as described, the switch *S*, at Boston, be placed so as to connect the relay *R*, with the key *K*, a message may be sent over the main line *Q*, *Q*, to the Providence end, where it may be connected with a receiving relay and received. Instead of this, however, this circuit is in this case connected by means of the wire *m*, with the Providence end of the second wire, Q^1, Q^1. The Boston end of Q^1, Q^1, is connected by the wire *n*, with the relay R^5, which we have referred to as not being connected by the remaining circuit of the sextuplex circuits. Under these circumstances the message sent from Boston to Providence by the key *K*, through the relay *R*, is received at Boston by the receiving relay R^5, the latter relay being connected as shown by the switch S^5, to the ground at *X*.

When the key *K*, at Boston, is connected to its front stop, as shown, an impulse goes out from the main battery, *M B*, and traverses the following circuit, viz., through the conducting wire *a*, *a*, to key *K*, switch *S*, relay *R*, conducting wire *b*, *b*, *c*, contact *d*, trailing arm *f*, conducting wire *e*, *e*, main line *Q*, *Q*, conducting wire *g*, trailing arm f^1, contact *h*, conducting wire *i*, *j*, *k*, *l*, and the remaining seven contacts to *m*, second main-line wire Q^1, Q^1, and conductor *n*, from which it passes through the receiving relay R^5, where it is received, and finally to the ground at *X*, through *o*, S^5, *p*, *q*, *r*, and *s*.

Now, the practical value of this experiment, as has already been pointed out, consists in the very evident fact that if the message can be sent from Boston to Providence over the sextuplex circuit and received back clearly and distinctly in Boston over an independent wire, then, since it makes no difference in what direction this independent wire may extend, no matter how far its distant end may be from the synchronized distributor, within say the limit of seventy-five or one hundred miles, important cities, lying within that distance of New York, can be readily placed in independent connection with Boston, and the outlying cities of Boston can be placed in independent connection with New York, by the operation of the two synchronized distributors, *A* and *B*.

Though the leg Q^1, Q^1, in this case was but fifty miles in length, yet, from what we have already said, it is evident that much greater distances could be successfully operated in this manner. With printing instruments, since seventy-two separate circuits can be maintained, the number of cities that can be connected with one another, by means of but two synchronized distributors, is clearly very great.—*Journal of the Franklin Institute.*



SYNCHRONOUS-MULTIPLEX TELEGRAPHY IN ACTUAL PRACTICE.

Electrical Review.

Published Weekly at 23 Park Row.

P. O. BOX 3329.

GEO. WORTHINGTON, }
WM. A. HOVEY, } - - - Editors.
THOMAS H. DELANO, - - - - Publisher.

SUBSCRIPTION.

United States and Canada, $3.00 per annum, in advance.

Great Britain and other foreign countries, $4.00, in advance. Postage free.

EDITORIAL ANNOUNCEMENT.

Address all communications and make all checks and P. O. orders payable to order of Delano and Company, Proprietors. P. O. Box 3329, New York.

We invite correspondence from Electricians, Inventors and the Telegraph and Telephone fraternity on matters pertaining to electrical and scientific subjects, and all facts of special interest in connection therewith.

We extend to manufacturers of electrical apparatus an invitation to send to this office any and all facts concerning their business which will be of interest to the public. We make no charge for publishing news.

Subscribers can at any time have the mailing address of their paper changed by sending both old and new address.

NEW YORK, SEPTEMBER 6, 1884.

CONTENTS.

	PAGE
An Extraordinary Experiment in Synchronous-Multiplex Telegraphy	1
Synchronous-Multiplex Telegraphy in Actual Practice	2, 3
Editorial Notes	4
Electrical Exhibition Opening	4
Concerning Joints	4
Brooklyn's Underground Estimates	4
Copper Wire—T. B. Doolittle's Experiments	4
The Drawbaugh Suit	4
Researches on Magnetism	5
Telephonic News	6
A Rhode Island Clam Bake	6
Music Over the Telephone	6
Okonite Insulated Wire	6, 7
Use of Dynamo-Electric Machines for Telegraphic Purposes	7
The Telegraph	7
Electrical and Scientific	8
The American Institute Fair	8
Electrical Exposition Examiners	8
Blackburn's Portable Testing Apparatus	9
The Electric Light News	9
New Electrical Patents	10

The Southern New England Telephone Company have started the long-distance telephone business between New York and Boston. Their office, in New York is corner Greenwich and Liberty streets.

We hope our friends in the telephone field will keep in mind the adjourned meeting of the National Association which occurs at the Continental Hotel, Philadelphia, on the 16th inst, and be on hand.

The hearing in the Drawbaugh suit has been postponed from September 15th to September 22d, and is to be held in New York instead of Syracuse. The arguments are to be made by Senators Conkling and Edmunds, the former on behalf of the Bell Company and the latter on behalf of the Drawbaugh Company, and will probably occupy some days.

At an Edison Electrical Exhibition at Worcester, last month, a very attractive feature of the exhibition was a floral pyramid about six feet in diameter, illuminated by lamps of various colors, arranged in six different circuits, each of which opened and closed once during each revolution, the pyramid being turned by an electric motor. A sewing machine and turning lathe driven by electrical energy were also shown. The audience was further entertained by a lecture given by Mr. Johnson, covering the whole subject of the derivation of light and power from coal through the agency of electricity.

In November, 1877, Mr. Thomas B. Doolittle, the well-known expert of the Bell Telephone Company, put up a line of hard-drawn No. 14 copper wire, five miles in length, at Ansonia. This was the first copper line ever put up for telephone purposes. It has been in constant use ever since, and has given the most entire satisfaction. Recently a portion of this wire has been taken down for examination, and we are indebted to Mr. Doolittle for a sample now before us. After seven years' exposure to the atmosphere, this wire shows no diminution in size, possible weight or conductivity, and is in every respect as good as the day it was put up. It has taken on a very fine bronze color, due to a very thin film of oxyde, but this film seems to have acted as a protection to the metal within, as a very little rubbing brings out the bright red of the copper. This, then, is the result of the best possible test, the test of actual practical experience, and it is well worthy the attention of all concerned in putting up telegraph and telephone lines. Iron wire, in time, is consumed by rust, and the process of disintegration begins as soon as it is exposed to the weather, and continues steadily, decreasing its conductivity and weight until, in a few years, it becomes useless for any purpose whatever, and its value as old metal will not pay the cost of taking it down. Copper, on the other hand, suffers no change, and is always, at the very worst, worth its value to be run down into ingot. Add to this that copper, for the same conductivity, is cheaper to-day than iron, and that by the present improved processes it can be made of ample tensile strength to hold itself up, and it will be seen that there is every reason to look for its very general use in place of iron at no distant day.

It is proposed by a German inventor to register the speed of trains while passing over bridges. According to this novel arrangement, there is fixed at each end of the bridge a pedal, placed against the rail so as to be depressed by each wheel of the train passing over the spot; each depression of the pedal makes contact in an electro-magnetic circuit, which, in part two, acts on needles placed against a cylinder situated at a convenient distance. This cylinder is made to revolve by clockwork, at a uniform speed, and is covered with a sheet of paper. While no wheels pass the pedals on the bridge, the needles mark straight lines, parallel, on the revolving paper sheet, but if contact is made as above mentioned, the respective needles are momentarily deflected, and mark the instant at which the wheel passes the pedal in connection on the bridge. Now, the distance apart of the pedals at each end of the bridge being known, as also the rate at which the registering cylinder revolves, the speed of the passing train can be deduced by simple measurement of the distance apart of the traces made by the marking needles.

THE EXHIBITION.

As will be seen by our report in other columns, the Electric Exhibition was formally opened on Tuesday, according to programme, but it was and is, at present writing, very far from being ready. An immense amount of work was crowded into Wednesday and Thursday, and by Thursday night things were comparatively settled, but there still remained much to do, and a great deal of apparatus that was not even unpacked, much less set up and connected. Still in this matter of unreadiness at the start, this exhibition is no worse than all exhibitions of all kinds that have gone before it, and it is safe to say that before another week has gone by pretty much everything will be in running order, and that the exhibition will amply justify the prediction of those who have claimed that it would prove the most interesting and important electrical exhibition ever held.

The building is admirably adapted for the purpose, and appears to be amply large enough to show everything. Had it been larger it is not probable that the number of exhibitors would have been greater. They would have simply increased the size of their exhibits, without adding anything to their importance, value, or interest.

The attendance, thus far, has not been large, but this is only natural, as the daily papers have distinctly told the public that the "show" was not ready. Whether there is sufficient interest in matters electrical to induce the slow-going people of Philadelphia to put out their money for the sake of seeing the exhibition, remains to be seen. Upon this depends its financial success.

But of its scientific success there can be no possible doubt. That is assured already. Never before has there been such an accumulation of electrical devices and apparatus, never has there been such an opportunity afforded for investigation and comparison, and never has there been such a bringing together of electrical experts and inventors with the opportunity to compare ideas and theories. It is an opportunity that is not likely to occur again soon, in this country at least, and no one interested in electrical matters, whether in a scientific, practical, or business way, can afford not to visit it.

BROOKLYN'S UNDERGROUND ESTIMATES.

It will be remembered that when the underground bill became a law the REVIEW advised the cities of New York and Brooklyn to get to work at once putting their fire alarm wires underground, partly in order to comply with the law, but chiefly to get their hands in so as to be ready to put all other wires underground before November 1st, 1885, the law making it obligatory upon the cities named to do the work themselves in the event of the failure of the companies to do so. It appears that in Brooklyn this suggestion was seriously considered, and, in accordance with instructions to make estimates as to the probable cost, Mr. Prescott L. Watson, Superintendent of the Telegraph Bureau, reports to Fire Commissioner Poillon of Brooklyn, that it would cost $322,360 to put the fire department wires underground. It is added, in the report from which we take this statement, that "Mayor Low questions the wisdom of the underground bill so far as it affects Brooklyn," a statement which can readily be believed in view of the above figures.

We have over and over again insisted that the underground bill, as it now stands on the statute books, is a hasty, absurd, and incongruous piece of legislation, which never would have passed into law had it not been for the unreasonable clamor set up by interested parties to secure it. Its provisions are so contradictory that in executing one another would be violated, and it is so loosely put together that nothing but the decision of a court can determine what it means. It ought not to be difficult to prove to the next legislature that it ought to be repealed or amended, and now that Mayor Low has found out what it means to the city of Brooklyn it ought not to be difficult to enlist his powerful aid in that direction. Unless the legislature is stupid beyond all conception, the electrical companies, by combined action, ought to be able to replace this ridiculous law with one that at least means something.

In this connection it may be well to call attention to the meaning of the above figures. The wires in Brooklyn that are used for and owned by the city in connection with its fire alarm service form but a very inconsiderable fraction of all the electrical wires in the city, and yet it is estimated that to bury them would cost over three hundred thousand dollars. It will readily be seen that, upon the basis of this estimate, if the telephone company were to sell its whole plant at what its construction has cost, and took the cost for it, it would not begin to have money enough to put its wires underground. Upon the basis of this estimate, thirty million dollars would be a very moderate figure for putting underground the various electric wires now overhead in New York, to say nothing of the money expended for the existing plant, all of which would go for nothing, for everybody knows that an entirely new outfit of wire would be needed. Is it not absurd to suppose that electrical interests can stand any such expense? Is it not ridiculous to suppose that they would not sooner go out of business than incur it, especially as there is no reason to suppose that the wires would work after they were down?

If this scheme is pushed, if the law remains on the statute books, and its enforcement is attempted when the time comes, there is one remedy that may bring the public to its senses. It is to SHUT DOWN. Let New York try one week without telegraph, telephone, district messenger, electric light or any other electrical service, and things will come to a head very quick. The press has dwelt upon the disadvantages which these services bring in their train. A week without any of them would give the public a realizing sense of their advantages, and the clamor would all be the other way.

CONCERNING JOINTS.

Every one having any experience in electrical matters at all knows that very much depends upon the perfection with which connections are made when it becomes necessary to make joints in the conducting wire. Of course it would be better, were it possible, to have no joints at all, but this is not practicable, and it becomes necessary to devise a connection which will have at once the tensile strength and the conductivity of the wire itself. It must always be borne in mind that, as the strength of a chain is determined by and limited to the strength of its weakest link, so the conductivity of a circuit is limited to the conductivity of that portion which offers the highest resistance.

So far as connections with such instruments as may be in circuit are concerned, there should be no trouble, for they are constantly under the eye, and can be and should be looked to at intervals to see that the contacts are bright and firmly clamped together. But in the matter of joints made between the different lengths of wire in the circuit it is far otherwise. They are hung high in mid-air, and any change that takes place in them cannot be either detected or remedied save at great inconvenience and expense. Hence the paramount necessity of making them perfect in the first instance—so perfect that they will remain permanent.

Consider, for a moment, the character of the joints usually made by telephone and telegraph line men. The wire is brightened, and then wound upon each other in the way familiar to every one. At first the contact is practically perfect, and the resistance no greater than that offered by the line itself. But how long does this last? The line is exposed to weather; water fastens itself upon the joint, and is drawn into the interstices between the wire. Corrosion begins at once, and, instead of a contact of bright surfaces, you have a layer between them of red rust. At first the increased resistance which this offers in the path of the current is not serious, but as time goes on the layer becomes thicker, not only at one joint, but at all joints, and the conductivity of the line becomes seriously impaired. When "galvanized" or zinc-coated wire is used, the trouble, though longer delayed, is, in the end, more serious. Gradually, especially in cities, where smoke and other atmospheric impurities have their effect, a thin crust of oxide of zinc forms on the joints, creeps in between the wires, and very seriously impairs the contact; for, while the red oxide of iron may be classed as a poor conductor, the oxide of zinc ranks as a very fair non-conductor, or insulator, and the resistance set up at each joint is, in the aggregate, such as to greatly impair the effectiveness of the line.

What, then, is the remedy? Clearly soldered joints. Make your joints as good as you can in the usual way, and then make them secure against change by the use of solder. How shall it be used? Not by dipping. Have a large soldering iron—one big enough to hold the heat, and a good deal of it—and, when your joint is made, apply the iron to it until the joint itself is hot enough to melt the solder. Then you will have a perfect joint, with perfect contact between the solder and the wire, with no danger of an intervening film of acids, as you are pretty sure to have when the joint is dipped

first into acid, and then into a pot of melted solder.

Of course, it is not to be expected that companies will go over all their lines and solder all joints, but they will all find it to their advantage to insist upon its being done on all new lines, and in all cases of repairs. Extra-territorial telephony would be far better and far more satisfactory than it is to-day were it not for rusted joints and the resistance which they offer

Opening of the International Electrical Exhibition at Philadelphia on the 2d Instant.

A SPLENDID DISPLAY OF ELECTRICAL INVENTIONS.

The inauguration of the Electrical Exhibition, on Tuesday last, was a success in almost every point of view. The weather was bright, clear and pleasant, and at an early hour the crowd began to gather around the handsomely-decorated arched doorway at Thirty-second Street and Lancaster Avenue, which is regarded as the main entrance. As usual, many of the exhibitors were behindhand with their work. Much energy is shown by those in charge, and in a very few days the exhibition will be in full blast. About 200 men were at work putting things in order, but they were hampered considerably by the fact that the exhibitors had not all sent their apparatus or devices. When everything is here, there will be about 2,000 exhibits, all told. Despite the large number of entries, however, the exhibition, from present appearances, will have more the character of an American than of an international exhibition. This is due to the overwhelming preponderance of exhibits from the United States. The present is the fourth large exhibition of electrical appliances.

This brief survey of only a few features which were seen affords a fair indication of what there is and is to be. It would be only making a catalogue to describe in the length of a newspaper article the divisions and the subdivisions, to enumerate the different contrivances which are displayed. Committees having among their number some of the best experts of the country are to examine with care and to pass upon the value of the exhibits. An electrical commission is to sit, and it comprises such excellent names as the following: Professors H. A. Rowland, M. B. Snyder, George F. Barker, E. J. Houston, F. C. Vandyck, John Trowbridge, C. F. Brackett, Simon Newcomb, J. Willard Gibbs, and C. A. Young, Dr. William H. Wahl, and Mr. R. A. Fish. Among those who will visit the exhibition and make suggestions are most of the eminent lights in physics in this country, as well as those attending the British Association. A great national conference of electricians will be held.

Concerning the opening ceremonies, they were largely attended. The hour of beginning the formalities was set at noon, but long before that time the buildings were comfortably filled, and Mayor Smith and Governor Pattison, two of the shining lights, were on hand. A procession was formed, headed by Mr. George H. Boker, and including a number of State and civic dignitaries, and the party was escorted to the lecture-room in the old railway station, where the Mayor delivered the address of welcome. The exhibition, he thought, illustrated in its magnificence the advancement of the united sciences and its growing importance to the mind of the scientist and the uses of the people. "To merely say," he added, "that the city of Philadelphia welcomes you here, would barely express the pleasure that is felt in your presence. With a sincere, hearty and generous greeting, she extends the hand of friendship, and tenders to you that cordial welcome which she trusts may make all who are within her limits feel the sincerity of her well-wishes."

The rapid progress made in the direction of electrical science during the past few years, and the vast possibilities in the application of this science, render the present exhibition one of immeasurable importance. As Governor Pattison happily remarked: "This is but the beginning of the entry into the rich storehouse of electrical science, and let us hope that this is the dawn of a new era. Great progress has been made in the past. Let us trust that the progress to come will be four-fold and ten-fold." He then concluded as follows: "With submission to the great Lord of Hosts, and by direction of the management, I do declare the National Exhibition of the year 1884 open."

Immediately upon this announcement the engines began to revolve, the motors moved, the lamps shone, the clocks ticked, and the organ pealed, all through electric agency; and the exhibition was open in fact as well as in name.

Direct Measurement of the Two Static Components and of the Dynamic Component of Collector Machines.

By M. G Cabanellas.

In the paper which I had the honor to read before the Academy, January 28, 1884, I called to mind that, by means of the individual yield of each of three organs of all transmission of power, to wit, the generator, the line, and the recipient, the product of these three individual values, the fractions F_G, F_L, F_R, gives exactly the value of F_T of the yield of the transfer.

I further reduced the analysis and then the synthesis of F_G, F_L, F_R to those of their simple determinant functions of the form $m = \frac{E}{R\,I}$. In this formula I is the *real* current, R the *effective* resistance, taking into account the deficiency, which I have pointed out and measured, and of which my memoir of April 28, 1884, enables me to fix the order of the cause. Lastly, E is the *real* electromotive force. We know that this force increases with the length of the wire coil in the electric field, but decreases with the magnetic field. If, then, we consider a machine with an invariable electro-magnet, and if we cause the distance of the armature to vary, it ensues that the space reserved for the induced coiling, and also the power of the magnetic field will be modified, exerting two respective variations in opposite directions on the electromotive forces created with the same speed, current, and section of the wrapping. Without entering into the complete discussion, it is evident that it is here necessary to determine the most favorable point in this series, and the component ratios of the resulting effect which characterizes each of these terms. The object of the present paper is to make known my method, *electrical* and *mechanical*, which permits me to realize such a desideratum in precise numerical terms.

The *effective* magnetic field of a collector machine is the resultant, 1 and 2, of two static components, the one due to the circulation of the current in the wire of the electro, the other due to the circulation of the current in the wire of the armature; 3, of a dynamic component which I have pointed out, and which is due to the action exerted by the totality of the currents of the wire of the armature upon the molecular currents constituting magnetism, in virtue of the movement of this electric field. Whether we have to do with a generator or a recipient the first *static* component is always *positive*, the second static component always *negative*, whilst the third (*dynamic*) component is *positive* in generators and *negative* in recipients. I have shown, especially as regards the experiments at Munich, the great relative value which this component may take in certain given conditions of sensibility of specific magnetism (non-compensated machines).

This being established, let us suppose a machine—Gramme, for instance—with the electro mounted upon knife edges, the edge being a prolongation of the axle of the armature, turning upon independent bearings, and supporting the brushes.

When in action I observe, at the speed of N rotations per minute the electromotive force, E_0, in an open induced circuit, the brushes being placed equatorially, the circuit of excitation of the electros being animated by the current I, from an external source

When at rest, the axle of the armature being leveled, I observe by gradual variation the angle of the brushes which gives the maximum yield for the couple, C_0 (*meters, kilos*), counterpoising the tendency to move the electro, whilst currents from external sources animate the circuits of the electro and of the armature.

In action, at the real rate, N I, of the machine serving as a generator, the brushes retaining the former position, I observe, always by direct weighing the couple, C, which counterpoises the tendency to carry along the electro in the direction of the rotation of the armature.

I calculate

$$E = \frac{2\pi C N g}{60\,I} \text{ and } E_1 = E\,\frac{C_0}{C}.$$

The magnitude of the effective magnetic field of this generator, at the rate of N I, expressed in volts, is therefore distributed as follows:

E_0 is the *primary positive static* component due to the circulation of the electro.

$E_1 - E_0$ is the *primary negative static* component due to the circulation of the armature.

$E - E_1$ is the *secondary positive dynamic* component due to the movement of the electric field.

Any increase whatever in the number of pairs of brushes and in the dimensions of the machines is not to any serious degree an obstacle to the use of this method. Setting out from a certain mass the entire electro ought to be supported in such a manner as to limit the strain upon the knife edges to an appointed minimum is to attach the electro to a float.

If it is useful to apply this kind of measurement to the recipient, the last component will be negative, and will be obtained in the same manner. In calculating, E, account must of course be taken of the passive couple.

To sum up, the present method, electrical and mechanical, of *quantitative analysis* leads directly to the *synthesis*, highly important, of the best proportions to be adopted for the electros and the armatures of collector machines.—*Comptes Rendus.*

Researches on Magnetism.

By M. Duter.

If we place a thin plate of steel in a uniform magnetic field, so that the lines of force of the field may be normal to the surface of the plate, we have a very flat magnet, the two faces of which are the two polar surfaces. The magnetic distribution thus obtained seems to disappear when the plate is no longer in the field. The following experiments show that this disappearance is not complete. I made use of plates of tempered steel of one millimeter in thickness, and varying in diameter from 0.040 to 0.005 meter. With these plates I formed cylindrical batteries. In some of these batteries the plates are directly in contact, and in others they were separated by leaves of pasteboard, the thickness of which varied from that of the thinnest paper to 0.001 meter. The batteries were placed in the central portion of a very powerful magnetic field, and after they had been taken out they formed perfectly regular permanent magnets. The supporting power of these magnets was the greater the nearer its constituent plates were to each other. In a battery of 100 plates, touching each other directly, and strongly pressed into a brass cylinder, the portative force at each extremity rose to 30 grammes. This first result having been obtained, I dismounted the batteries, plate by plate, taking care to mark the upper and under side of each. I found then that each plate retained only an excessively slight magnetism. Yet each of them still constituted a flat magnet, of which the two faces are the polar surfaces; for on rebuilding the battery it gave again a perfectly regular magnet, though weaker than it was at first. The separation of the magnet into its constituent plates, and its reconstruction, may be repeated indefinitely. —*Comptes Rendus.*

Our correspondent at the Philadelphia Electrical Exposition on Tuesday last says that no sooner had the gubernatorial edict gone forth than the machinery was set in motion, thousands of electric lights burst out to shame the daylight, and the wonderful fountain, a central feature, begin to play, forming a spectacle more enchanting than any stage picture, and dazzling the spectators by transferring them in a moment from a prosaic hall to an Aladdin's palace. The large crowd were enthusiastic and evinced their pleasure by hearty applause. Several prominent electricians who had attended the expositions held in Paris, Munich and Vienna all agree that this is better in all respects than any of its predecessors.

The British Postmaster-General has notified the telephone companies that he is prepared to grant licences to allow them to connect with postal telegraph offices. This will enable subscribers to the telephone companies to telegraph to any part of the United Kingdom without extra charge. The Government has abandoned its claim to a royalty of ten per centage on private wires.

Mr. C. Masden, director of the telephone company at Copenhagen, has devised a new overhead cable which is being manufactured by Messrs. Felten and Guilleaume, of Mulheim. The cable contains 25 conductors, is only 15 millimeters in diameter, that is little more than half an inch, weighs .6 kilogramme per meter (equal to .4 lb. per foot), and possesses a tensile strength of 1500 kilo-gramme. Spans of 70 meters (230 ft.) are considered quite admissible, and the cable is handy and flexible and yet strong. The insulation is expected to withstand all atmospheric influences.

The Recent Decision in the Brush Case.

Editors Electrical Review:

The Brush Electric Company, of Cleveland, in view of the recent decision of Judge Shipman, declaring one of the main Brush patents null and void, have thought it necessary to publish a circular, with the apparent object of counteracting the effect upon their agencies and local lighting companies of such decision. In this circular they claim that suits are in progress against the users of half a dozen different systems of electric lighting, and they add that "suits are also in preparation against other infringers, including the Thomson-Houston System, which infringes some of our most important patents on the dynamo machine."

I do not know what grounds the Brush Company may have for bringing suit against many of the companies named. With reference to the Thomson-Houston Company, however, I am in possession of information which renders any such action on the part of the Brush Company quite improbable.

I am credibly informed that this company, some two years and a half ago, voluntarily loaned the Brush Company a dynamo and lamps for examination; that the Brush Company, after keeping the apparatus some eighteen months, returned a portion of it and retained the rest.

It is a fact well known to every well-qualified expert in electrical science that the individual character and great originality of the Thomson-Houston patents are such as to render any successful attack upon them by the Brush Company, upon any assumption of infringement, entirely out of the question. That this company may, in the fullness of the folly which has in the past characterized its course with reference to electric patents in general, bring suit against the Thomson-Houston Company, as well as many others, is possible; but that it will never do so with any other object in view than that of intimidating some intending purchaser of lighting apparatus I am very sure.

In making this statement I do not forget that all the arc light systems in common are using copper-coated carbons, concerning which the Brush Company has in the past made claims. In their circular, however, they are careful not to remind the public that a suit on the question of copper-coated carbons was begun by them at the same time with their disastrous suit on the lamp clamp, that hundreds of pages of testimony were taken, and the record completed, and that, just before the hearing, the Brush Company, not daring to argue the case, withdrew the suit, paying all the cost thereof. X.

Telephonic News

*** The Baltimore *American* is making a telephone connection between Baltimore and its Washington office.

*** The banner exchange of the "Sunset Telephone Company" is at Los Angeles, Cal, a place of about 30,000 inhabitants, which scores 360 subscribers. The rates are $60 per annum, and 5c. for each connection.

*** Vice-president John J. Sabine, representing the Pacific coast telephone interests at the Electrical Exposition and Telephone Convention, to be held in Philadelphia, makes a good showing of the progress in the telephone field in California for the year past.

*** General-Superintendent Cassidy, of the Honolulu Telephone Company, is visiting the Electrical Exposition. Mr. Cassidy still claims to have more subscribers in Honolulu, in proportion to the number of inhabitants, than any city in the world. The population is about 16,000 and the exchange scores 465 subscribers. The opposition company, which started in with $30,000 in cash and a good plant, have retired from the business, not having been able to get paying subscribers enough to defray expenses. Evidently competition in the telephone business doesn't pay.

*** Vice-Chancellor Van Fleet, at Newark, on Saturday last, granted an injunction restraining the New York and New Jersey Telephone Company from using the Bell telephones in the city of Newark, and the townships of Harrison and Kearney, and from obstructing or interfering with the Domestic Telegraph and Telephone Company. The order was granted at the instance of the Domestic Telegraph and Telephone Company. This company uses the Bell telephones. The New York and New Jersey Co. proposed to use the same telephones, and to establish a line in Newark. This injunction will not hold as the contract held by the Domestic Telephone Company has expired, we understand.

*** At Cincinnati the County Commissioners have entered into a contract with James M. Bell, of Columbus, whereby he is to be paid ten per cent. of all taxes collected from the Bell Telephone Company, in this city. The Columbus man represented to the Commissioners at a recent session that the local telephone company rents the instruments now in use from the American Bell Telephone Company, at the rate of $20 per annum for each instrument. Mr. Bell's theory is that the local company's instrument should be listed for taxation according to their earning power, which, for taxation, would make the value of each instrument $33⅓. The managers of the local company regard this idea as preposterous, and it is said that when the matter comes before the Commissioners they will present a statement, showing that if this property were listed in detail the total would be $11,000 less than is now listed in bulk. The case promises to become interesting shortly.

A Rhode Island Clam-Bake Complimentary to Telephone, Telegraph and Electric Light Men.

The sixth annual clam-bake tendered by the American Electrical Works, of Providence, Mr. Eugene F. Phillips, President, to Telephone, Telegraph, and Electric Light men came off on Wednesday, Aug. 27th. The day was a perfect one, and as early as nine o'clock the guests, who came from far and wide, and numbered in all something over one hundred, began to assemble in the office of the Telephone Exchange, where they were received by Mr. Phillips and Mr. Duxbury. At eleven o'clock the first contingent started by steamboat for Silver Spring, a short distance down the bay, where the comfortable and elegant establishment of the Vere de l'Eau Club was found in readiness for them. The next boat brought another lot, and the next swelled the party to the numbers named. The large field back of the club house was promptly appropriated by the base-ballists of the party, and after an informal lunch a regular game was had. Then a foot-ball was brought out, and all hands, young and old, became boys for the nonce, and indulged in a frolic. Meantime the clam-bake fire had been kindled, and when the stone circle had been sufficiently heated the clams and potatoes were put to bed on their fiery couch, with an ample covering of wet sea-weed. Dinner was announced soon after, and the crowd filed in, filling every seat at the long tables. There was little or no formality, but there was an abundance of good cheer, and all fell to with an appetite sharpened by the bracing breeze and the games of the morning. Those who have eaten one of these "Shore Dinners" that Mr. Phillips engineers don't need to be told about it, for memory will do more than words possibly could, while for those who have not been so fortunate words would only be an aggravation. Suffice it to say that better cooked clams, a more delicious chowder, or sweeter corn were never set before guests. After dinner there was clay pigeon shooting, wheelbarrow racing, and other sports, and towards evening the party broke up and separated for home. It was, in every sense, a "day off" for everybody present, a day of pleasure and of many happy meetings and greetings, a day that had been looked forward to with the brightest anticipations, no one of which has failed of realization in every particular. And for all this those who partook of its pleasures are indebted to the thoughtful kindness of their host, Mr. Eugene F. Phillips.

The following are the names of those who participated:

John I. Sabin, General Manager Pacific Bell Telephone Company, San Francisco, Cal.; G. M. D. Fernald, electrical manufacturer, Boston, Mass.; F. B. Knight, General Agent Palmer Wire Company, New York City; Charles Sylvester, Superintendent Southern Massachusetts Telephone Company, Fall River, Mass.; George M. Robertson, Chief Clerk Western Union Supply, New York City; Stephen D. Field, Electrician, Yonkers, N. Y.; William Mackintosh, Providence, R. I., Inventor of Underground System of Telegraphic Conduits; W. W. Rider, General Manager Mutual District Telegraph Company, New York City; E. B. Baker, General Superintendent Southern New England Telephone Company, New Haven, Ct.; W. S. Crofut, Division Superintendent Southern N. E. Telephone Company, Providence, R. I.; J. Jepson, Division Superintendent Southern N. E. Telephone Company, Norwich, Ct.; J. Judson, Division Superintendent Southern N. E. Tele. Co, New Haven, Ct.; A. M. Young, Division Superintendent Southern N. E. Telephone Company, Waterbury, Ct; E. C. Perkins, Providence, R. I., Agent Boston Electric Company; F. F. Downes, Manager Electric Light Company, Newport, R. I.; H. J. Miller, Automatic Fire Alarm and Extinguisher Company, Boston; C. H. Bullock, Providence Telephone Company, Pawtucket, R. I.; Charles E. Lincoln, Reporter Providence *Evening Press*, Providence, R. I.; R. S. Taber, Southern Massachusetts Telephone Company, New Bedford; W. K. Wagner, Southern Massachusetts Telephone Company, New Bedford, Mass.; J. Ogden, New York; H. W. Bradley, New York; H. L. Shippy, Agent Roebling Wire Works, New York; I. H. Hingle, Superintendent Supply Mutual District Telegraph Company, New York; David R. Walker, Superintendent Fire Alarm, Philadelphia, Pa.; Joseph H. Paist, Clerk of City Council, Philadelphia; Reginald C. Brown, Superintendent Rhode Island Electric Light Company, Providence, R. I.; William Brophy, Superintendent Fire Alarm, Worcester, Mass.; L. W. Breckenridge, Boston Electric Time Company, Boston, Mass.; F. E. Durfee, Providence, R. I.; J. F. Hedge, jr., Superintendent Electrical Department, Rhode Island Telephone and Electric Company; Providence, R. I.; F. H. Gardiner, Assistant General Manager Rhode Island Telephone and Electric Company, Providence, R. I.; Augustus Wright, Providence Telephone Company, Providence, R. I.; William A. Hovey, ELECTRICAL REVIEW, New York City; W. H. Sawyer, Secretary and Electrician American Electrical Works, Providence, R. I.; F. H. Angell, American Electrical Works, Providence, R. I.; W. A. Hathaway, American Electrical Works, Providence, R. I.; G. C. Sims, Armington & Sims Engine Company, Providence, R. I.; Henry H. Sherman, Atlantic Manufacturing Company, Providence, R. I.; Col. A. C. Eddy, Bristol, R. I.; I. M. Melloy, Philadelphia; Wm. H. Kenyon, American Electrical Works, Providence, R. I.: D. J. Grimes, Amer. Elec. Works, Providence, R I; E. C. Winn, Amer. Elec. Works, Providence, R. I.; M. Donohue, American Electrical Works, Providence, R. I; Daniel Field, American Electrical Works, Providence, R. I.; Frank Ladd, American Electric Works, Providence, R. I.; Albert H. Thornton, American Electric Works, Providence, R. I.; A. H. Nickerson, American Electric Works, Providence R. I.; Mark A. Evans, American Electric Works, Providence, R. I.; Geo. W. Evans, American Electric Works, Providence, R. I.; Geo. T. Manson, Superintendent Supplies New England Telephone Company, Boston, Mass.; J. M. Oram, Boston, Mass.; Geo. A. Trouvelot, Boston, Mass.; C. Q. Whitaker, Providence, R. I.; J. W. Duxbury, General Manager and Superintendent Providence Telephone Company, Providence, R. I.; A. C. White, Assistant Superintendent Providence Telephone Company, Providence, R. I.; James Menzies, New England Telephone Company, Boston, Mass.; Thomas D. Lockwood, Electrician American Bell Telephone Co., Boston. Mass.; W. A. Hall, Manufacturer of Electrical Apparatus, Boston, Mass.; W. H. Anthony, New England Telephone Company, Boston, Mass.; W. J. Johnston, *Electrical World*, New York; H. B. Lytle, Massachusetts Electric Time Company, Boston, Mass.; Geo. W. Piper, Newburyport, Mass., of Domestic Electric Manufacturing Company, Boston; J. B. Gardiner, Newburyport, Mass., of Domestic Electric Manufacturing Company, Boston; William H. Leslie, Boston; John Haile, Warren; Charles G. A. Peterson, Manager Messenger Department, Providence Telephone Company, Providence, R. I.; Dr. Wm. F. Channing, Providence, Inventor of Fire Alarm System; W. S. Hill, Boston, Mass, Superintendent of Electrical Exhibition to be held in Boston; P. H. Alexander, Boston; Louis Hill, Boston; Samuel Norris, Bristol, R. I.; H. C. Langstaff, Inspector Providence Telephone Company, Providence, R. I.; Wm. B. Vansize, American Bell Telephone Company, Boston, Mass.; John C. Wilson, Electrician, Boston, Mass.; Henry W. Breckenridge, Electrician Providence Telephone Company, Providence, R. I.; Thomas H. McElroy, Reporter Providence *Daily Journal*, Providence, R. I.; Henry H. Harris, Assistant Treasurer Providence Telephone Co., Providence, R. I.; Richard D. Knight of Livermore & Knight, Providence, R. I.; George W. Adams, Boston Electric Protective Company, Boston, Mass.; F. A. Hanaford, Chief of Construction New England Telephone Company, Boston, Mass.; J. W. Peck, Boston, Mass., of Northern New York Telephone Company; Charles H. Porter, Boston District Messenger Company, Boston, Mass.; Weston Lewis, Electrician, Boston, Mass.; H. J. Pettengill, Manager Bankers and Merchants' Telegraph Co., Boston, Mass.; A. L. Suesman, Manager Bankers and Merchants' Telegraph Company Providence, R. I.; Mark S. Lewis, Electrician, Boston; Benjamin L. Allen, Manager, Providence District Messenger Company, Providence, R. I.; P. Fahey, Superintendent Brush Electric Light Company, Boston; S. L. Burden, Providence, R. I.; D. A. Gage, Pawtucket, R. I.; W. O. Sayles, New York; L. B. Darling, Electric Light Company, Pawtucket, R. I.; C. H. Bogle, Telegraph Line Constructor, Providence, R. I.; Abiel F. Davis, Chief Operator Western Union Telegraph Company, Providence, R. I.; Walter P. Phillips, Associate Press, New York; H. C. Bradford, Superintendent Narragansett Electric Light Company, Providence, R. I.; D. L. Mitchell, Electric Light Company, Taunton, Mass.; A. W. Robinson, California; E. M. Carhart, Manager Holme's Burglar Alarm Company, Providence, R. I.; J. F. Johnston, Inspector Providence Telephone Company, Providence, R. I.; C. R. Remington, Jr., Providence, R. I., American Electrical Works; J. M. Addeman, Secretary of State, Providence, R. I.; E. F. Phillips, President Amer. Electrical Works, Providence, R. I.; N. P. Hicks, Pawtucket, R. I.; Cozzens & Bull. Proprietors Newport Telephone Exchange, Newport, R. I.; P. J. Hurlburt, Manager Western Union Telegraph Company, Providence, R I.; H. R. Barker, Providence, R. I.; Frank S. Mead, American Electric Works, Providence, R. I.; L. W. Clarke, Electrician, Providence, R. I.; Dr. F. H. Peckham, Jr., Providence, R. I.; J. O. Darling, American Electric Works, Providence, R. I.

Music Over the Telephone.

The Telephone Exchange, under the management of Mr. C. A. Read, gave the surrounding exchanges, of which this is the center, a complimentary concert recently, and those who heard the delightful music of Meine Brothers' splendid orchestra, as transmitted for miles and miles over the wires, expressed themselves as highly entertained. The soft, sweet, soul-stirring strains fell upon hundreds of appreciative ears. The orchestra was seated in a large room in the exchange, in which there were six transmitters—Waxahachie, Lancaster, Terrell, McKinney, Fort Worth, Cleburne, Waco exchanges, and Dallas subscribers were treated to a musical feast. The music, as heard at home, was splendid. The pieces played were the Concert March grand selection, "Martha;" medley, popular airs; overture, "Welcome;" serenade, flute and cornet, "Die Industriellen." The concert began at 9.30 and closed at 12.30.—*Dallas Herald.*

Okonite Insulated Wire.

There has recently been brought to our attention a new insulating material for electric conductors, and samples have been submitted to us for various sized wires covered with the same.

The manufacturers of this material are a company formed under the title of the New York Insulated Wire and Vulcanite Company, 13 Park Row, N. Y., and have their manufactory in connection with that of the New York Belting and Packing Company, the well-known rubber manufacturers, at Passaic, New Jersey.

They have adopted as a trade mark the word "Okonite." The management of the Insulated Wire Company is in experienced hands. Its President, Mr. Chas. A. Cheever, who will be remembered as one of the pioneers in the introduction of the telephone, and many of our readers will remember him in connection with this subject.

The insulating material is composed of rubber and various other ingredients, some of which have never been used before for this purpose. The compound is invented by Mr. J. J. C. Smith, an old and experienced manipulator and manufacturer of rubber, and it is his knowledge and familiarity with chemistry, as more particularly confined to the manufacture of rubber, that is to be attributed the successful result which has been obtained.

The company claim that the insulation which they produce more nearly resembles the desired qualification of an ideal insulated conductor than any other.

The wire presents a very attractive exterior, differing in material points from all other wires covered with rubber compounds. It has brilliant jet black color, smooth and polished surface, perfectly uniform in size. It is pliable, and at the same time exceedingly tough and tenacious.

The Okonite wire can be twisted in any conceivable manner, even to the extent of

breaking the copper wire in its center, and the covering will be found to be still intact and without a crack upon its surface. The insulating compound is of a homogeneous nature. Cutting it with a knife it presents a grain similar to that of finely grained cedar wood; its adhesiveness to the wire is very remarkable, requiring considerable force to detach it.

By even a superficial examination it is apparent that the method of its manufacture must be different from all other insulated wires, which fact we understand is the case.

By an ingenious process the wires are covered longitudinally, thus securing an unbroken line of insulating material, with the wire always in the center—a very *important factor* with insulating wires.

We have been informed by Mr. Cheever that no wire of their manufacture is permitted to leave the establishment without being submitted to the most rigid tests, consisting in part of the submerging of each coil of 1,000 feet in a tank of water sixty degrees Fahrenheit for several days, when it is taken out, and foot by foot its insulation, its specific resistance and its continuity of insulation are tested by a Thompson astatic mirror galvanometer to a point fifty per cent. above the resistance guaranteed by the company.

That this covering material is necessarily of high resistance is proved by showing it to be entirely waterproof. A fact not generally known to the public is furnished us by the manufacturers, which is of general interest, *i. e.*, that rubber, either natural or vulcanized is not entirely waterproof, the general opinion to the contrary notwithstanding. This can easily be demonstrated by soaking a piece of rubber in water for 24 hours, first having noticed its weight, and again by weighing it after the 24 hours' submersion, when its weight will be found to have increased; the percentage of water absorbed by pure rubber is about three per cent., in compounds of vulcanized rubber about five per cent.

The New York Insulated Wire and Vulcanite Company claim that their covering material is an entirely new compound, in which rubber forms the basis, but with other material not before used, and such new combinations as to make it positively proof against water, as also against the action of acids, either pure or diluted, or the corrosion of alkalies, upon which fact they justify their claim for improved durability.

As the substance is a vulcanized compound it is clear that it will bear heat to 250 degrees Fahrenheit, and to that degree the compound remains intact. Coils frozen to far below zero have been suddenly subjected to the above degrees of heat without any noticeable effect, even after repeating this test several times.

The company has been but recently organized, and with their limited capacity of machinery, they have been unable to supply the demands which were brought upon them by a few large customers, hence they have kept their product in the background, which accounts for the fact of its not being more generally known.

Among the larger users who have had experience with the wire may be mentioned The Postal Telegraph Company, who have the wires in use in their underground conduits at Washington, D.C., enclosed in lead; in cables at Chicago, Ill., and in overhead wires and cables at various other points.

The Union Switch and Signal Company have expressed themselves as well pleased with the results of its use in their automatic railroad signal service.

The company refer to several other prominent parties for endorsement of their product, and state they have no hesitation in subjecting their wires to any competitive test for any of the qualifications necessary to the most desirable insulated wire.

The Telephone Girl Disgusts a Purchaser of Groceries.

The telephone girl was singing "Sweet Violets," when a hasty call broke her right off at the place known as "sweeter than all the roses," and she snapped out two or three womanly cuss-words before deigning a reply. After sundry delays, she condescended to let No. 73 know she was there and heard:

"Hello!"

"Hello!" she replied.

"Give me Printblossom's grocery."

"What number?"

"One, of course, you goose."

"No. 1 is Pillpickle's law office."

"Oh! I meant one grocery store. Its call number is 422." No. 422 was switched on in a jiffy, having been called as soon as asked for, the provoking girl asking the number merely for delay.

"Hello, Printblossom!"

"Hello!"

"What ails that butter you sent down this evening?"

"Butter; Who am I talking with?"

"Mrs. Coobill. I want to know what ails that butter you sent me this evening?"

Here the girl switched on a man who was telling his employer what he found in the cistern which he had cleaned out that day, his employer just having remarked: "I suppose there was a graveyard in it," and the hired man replied:

"There were eleven dead rats and a lot of dog hair and stuff in it, but I've cleaned it all out nicely and now it's just as good as new."

Mrs. Coobill hung up her receiver with a clatter like a thunderbolt, and Printblossom wonders why she don't buy groceries of him anymore.

On the Use of Dynamo-Electric Machines as a Substitute for Telegraphic Batteries.

By M. Rothen.

In presence of the rapid development of dynamo machines, the thought must naturally occur to every telegraphist that it might perhaps be of advantage to substitute for batteries these novel generators of electricity. This idea has in it something enticing, if we consider that no generator furnishes electricity as cheaply as do dynamos, and that, on the other hand, the maintenance of batteries occasions much inconvenience. However clean they may be when first put together, they soon become dirty, a fault from which none of the numerous forms employed is entirely free. Crystals are soon produced, which climb up the sides of the cells to redescend at the outside; porous vessels become impermeable, or their outsides are covered with coppery arborescence; the zincs are covered with crusts adhering firmly, and which all efforts are unable to remove; at the bottom there are deposited blackish pastes, not precisely defined; the contacts with the wires become oxidized. All these inconveniencies of batteries are but too well known to telegraphists, and it is not necessary to dwell on them longer in order to show that, as regards cleanliness and ease of maintenance, it would be advantageous to substitute dynamos for the batteries.

As far as regards the cost of electricity supplied in the one or the other manner, the question seems to us of less importance. It is needful to remark at the outset that the cost of maintaining batteries has been made the subject of very variable valuations by different telegraphic administrations, depending, besides, on the systems in use. Whilst in some countries the mean annual expense is reckoned at three francs per element, in others it is valued only at one franc, or even less. The real amount of the outlay for maintaining batteries is therefore difficult to calculate with certainty. As to the expense of obtaining electricity from dynamos to say that they are the cheapest source is correct only under certain conditions. In the first place, there must be a great demand for electricity and little variation in this demand. But even admitting that in telegraphic offices exploitation by dynamos is more economical than by batteries, it does not necessarily follow that the former should be adopted. We find here relations similar to those which exist between the material of great works of art and that of instruments of precision. For an iron bridge it is necessary to calculate carefully the capacity of the iron in order to arrive at a sufficient stability with the minimum of weight, for it is the weight which forms the chief item in the sum total of expenditure. For an instrument of precision, the quantity of materials employed plays only a very insignificant part in the total cost, and we do not think of calculating the force of resistance of the metal. The dimensions are often ten times in excess of what they might be if we confined ourselves to what is strictly necessary.

The same considerations present themselves in the production of electricity, on the one hand for the electric light and the transmission of power, and on the other for telegraphy. In the former case this production constitutes the preponderating element of the expenses. Hence all efforts are directed towards reducing its price. In the second, the quantity of electricity required is so small that a trifle more or less in the cost of production has no appreciable influence on the total expenditure.

If to these considerations we join, further, those drawn from the special circumstances met with at the majority of small intermediate offices, the question, in its general application, is quickly decided in favor of batteries. For great offices where the main mass of telegraphic business is concentrated, the conditions, it is true, are different. The consumption of electricity there is much more considerable, and there, especially where the system of special batteries for each line is in use, and where, consequently, the number of elements may sometimes reach 20,000, the substitution of dynamos for batteries is of more interest.

The first attempts made, to our knowledge, in this direction are those of Louis Schwendler, in his lifetime chief electrician to the Administration of British India. The *Journal Telegraphique* (vol. IV., p. 621) has published the report of this official on the experiments of October 14, 1879, made between the offices of Calcutta and of Agra, a distance of 1,350 kilometers. These experiments Schwendler resumed in a more complete manner at the end of August, 1880. A Siemens dynamo, model A, was placed at the railway station of Howrah, distant 2.8 kilometers from the telegraphic office of Calcutta. The negative pole of the machine was placed in communication with the earth by means of three copper plates having a total resistance of 1.67 ohm. The other pole was in communication with a telegraphic wire conducting the current to the Calcutta office, where ordinary manipulators directed it in succession to different telegraphic wires.

It was not forgotten that the mere influence of a telegraphic circuit is unable to prime a dynamo.

It was, therefore, necessary to establish at Howrah a second circuit, of feeble resistance, either a circuit destined to serve a Serrin arc lamp, or an auxiliary wire of the resistance of 0.517 ohm.

A preliminary experiment was made on August 28th with the wire from Calcutta to Allahabad of the length of 928 kilometers. The resistance of the line was 3,075 ohms, and that of the recipient apparatus at Allahabad 492 ohms. The principal current, furnished by the dynamo, showed on a tangent galvanometer 37.9°, which, if we take as a standard the measure of the horizontal component of terrestrial magnetism, represents as the force of the current in amperes 47.33 tangent 37.9°=36.846 amperes. The current traversing the telegraphic line was 0.0145 ampere, of which 0.0077 arrived at Allahabad. With the battery of 60 Minotto elements commonly employed, these two values were respectively 0.0098 and 0 0051 ampere. Of the total current furnished by the machine the telegraphic wire only absorbed, therefore, a fraction of about $\frac{1}{1000}$.

The formal experiment took place the next day, August 29th. With the current derived from the dynamo they telegraphed on eleven different lines, which are ordinarily worked with batteries varying from 20 to 195 elements. In all cases complete success was obtained, but the derived current was never sent on more than a single line at once. Except on the line from Calcutta to Agra, which represents a resistance of 75.29 ohms, and which is habitually worked with a battery of 195 elements, the derived current of the dynamo was always stronger than the current furnished by the battery.

Government Telegram Rates.

The following letter was sent to the Postmaster-General, several days ago, by Mr. Bates, of the Baltimore and Ohio Telegraph Company:

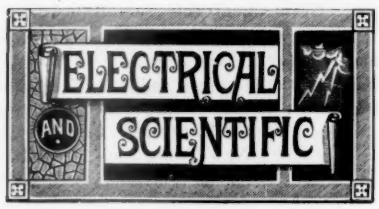
United Telegraph Lines,
New York, Aug. 15, 1884.

The Hon. Walter Q. Gresham, Postmaster-General.

Dear Sir: I beg to acknowledge the receipt of a communication from your department, dated July 31, addressed to Mr. Robert Garrett, calling attention to your circular fixing telegraphic rates for the fiscal year ending June 30, 1884, and asking for suggestions on the subject. Mr. Garrett has placed the matter in my hands for reply, and I beg to submit for your consideration the following suggestions:

The united telegraph lines, which embrace the Baltimore and Ohio, the Bankers and Merchants' (including American Rapid), and the Postal Telegraph and Cable Company, have a telephonic system extending from Boston, by various routes, to Chicago, St. Louis, Minneapolis, Kansas City, Dallas, Galveston, New Orleans, Charleston, Savannah, Atlanta, and all important cities and towns within that area, of a total population in the United States of 12,000,000; in places of 5,000 or over the united telegraph lines reach nearly one-half of such places in number and 9,400,000 in population. Its lines include nearly 120,000 miles of wire, in connection with the Mackay-Bennett ocean cables, and are by far the largest and most comprehensive competing system ever established in this country. We respectfully represent that the low charges on Government and public messages heretofore in operation are due entirely to the existence of competing companies. The basis of telegraph rates proposed in the report of the Senate Committee on Post-Offices and Post-roads on the Postal Telegraph Bill at the last session of Congress, under a five years' contract, is as follows: For day messages of 20 words, exclusive of date, 20 cents for distance within 100 miles, and an additional charge of 5 cents for each additional 250 miles or fraction thereof, but for no distance is the rate to exceed 50 cents; for night messages not exceeding 20 words, exclusive of date, the rate to be 15 cents for all distances under 2,000 miles, and for greater distances 25 cents. For both day and night messages an addition of one-fifth the rate to be made for every five words or fraction thereof in excess of 20 words. I beg, on behalf of the united telegraph lines, to offer the above-named rates for all Government messages between the points reached by our lines, from September 1, prox., during the present fiscal year ending June 30, 1885; but, in view of the difficulty at times in readily determining the distances between offices, the following division of territory is proposed instead of the limit of 1,000 miles, etc., given in the Senate Committee's report: All that section north and east of and including Virginia, Kentucky and Missouri, day messages, 20 cents for 10 body words and 1 cent additional for each additional word; all that section south of Virginia, Kentucky and Missouri, to and including Texas, day messages, 20 cents, for 10 body words and 1 cent each additional word. Interchargeable, between upper and lower zones, the rate on day messages to be 50 per cent. additional for the first 10 words and 1 cent for each additional word, it being understood that the 20 cent rate shall apply in all cases on day messages from one State to points within an adjoining State. For night messages within either of the sections above named, 15 cents for 15 words and 1 cent for each additional word, and from one section to points within the other section, 25 cents for the first 15 words and 1 cent for each additional word, it being understood that the 15 cent rate shall apply in case on all night messages from one State to points within an adjoining State, night messages to be filed at any time before midnight for transmission during the night and delivery at destination on the morning of the next succeeding business day. We suggest the basis of 10 body words for day messages, because it is the general custom of telegraph companies to make their charge upon that basis, but if you prefer to retain the provisions in your previous circular, fixing the charge upon the basis of 25 words, including address and signature, our offer may be modified to that extent for both day and night messages. We are prepared to transmit promptly and efficiently all Government telegrams between points on our lines, and respectfully urge that, in view of this unprecedented offer, we should be entitled to the patronage of the Government exclusively, and upon conditions that our services shall be efficient and satisfactory to the respective Government departments.

Yours, very respectfully,
D. H. Bates, Executive Manager.



* * The Jarvis Engineering Company, of Boston, have recently sold an Armington & Sims engine to the United States Illuminating Company for their Stanton Street Station in New York City.

* * Mr. Thomas D. Lockwood, chief of the electrical department of the American Bell Telephone Company, Boston, has been selected by the managers of the Electrical Exhibition at Philadelphia as a member of the board of examiners, to pass upon the merits of the electrical exhibits, and has also been appointed a member of the National Conference of Electricians, which meets in Philadelphia, September 18.

* * Some remarkable photographs of a pistol bullet in its flight, under the illumination of an electric spark, have been secured by Prof. E. Mach, of Prague. He has also photographed the air streams which one may see over a Bunsen burner placed in sunshine, and has even obtained pictures of waves of sound, these last being made visible by a method in which advantage is taken of the irregular refraction of light by the air set in vibration by sound.

* * The London *Economist* is authority for the statement that the Pennsylvania Railroad Company controls the largest income of any joint stock company in the world. The greatest English Company—the London and Northwestern—last year earned a gross $53,500,000, or, including "controlled undertakings," possibly $60,000,000; while on the Continent the most important line—the Paris, Lyons and Mediterranean—earned a gross $70,000,000. Such figures are a long way short of the Pennsylvania receipts, which last year exceeded $100,000,000.

* * Mr. F. Maxwell-Lyte writes to the *Electrician* that the lead peroxide, as used in the De la Rive battery, must be prepared by the usual process of acting by means of nitric acid on the red lead of commerce. A far less expensive method, patented by Mr. Maxwell-Lyte, consists of adding to lead chloride, dissolved in hot water, a sufficiency of bleach solution and the right proportion of calcium hydrate. By this means lead peroxide of from 90 to 100 per cent. may be produced and sold, with a fair margin of profit, at about 3¼d. per lb. This could not contain the nitric acid complained of.

* * "The possibility of ascertaining the standard fineness of alloys by the aid of electricity," says Professor Chandler Roberts, F. R. S., in his Cantor lectures, "long ago occupied the attention of physicists. In 1823 Becquerel suggested that trustworthy indications might be afforded by the electromotive force developed when the alloy to be tested is placed in an exciting fluid together with an alloy of known composition. The subject was partially investigated by Œrsted in 1828, and its practical importance was further pointed out by Gay-Lussac in in 1830. In 1878 the use of magnetic induction for indicating the composition of alloys was suggested by Professor Hughes, who showed incidentally that the induction balance affords a ready means for detecting counterfeits, and I have elsewhere pointed out the degree of accuracy of which this instrument is susceptible."

* * Several trials have recently been made at Berlin of dynamo currents for the working of the telegraph lines, and have proved quite successful. The current was furnished by a continuous-current Siemens machine, having its electro magnet excited by a small dynamo. The machine had a difference of potential of forty volts, and supplied twelve subterranian and two aerial lines with Hughes' apparatus, together with eleven subterranean and twelve aerial lines with Morse apparatus, and, lastly, three lines on closed circuit. It was found that the work could be done very well on lines which required from twenty-five to eighty cells to work them, and that there was a slight gain of speed on the subterranean lines. It would appear, on the whole, that dynamos will be useful in large stations, where they will effect a notable economy in the cost of current; but for small local offices the battery is the most convenient apparatus.

The American Institute Fair.

The Board of Managers of the American Institute of New York have already commenced arrangements for their fifty-third annual exhibition, which will be opened on September 24th next, at the Institute Building, Third Avenue and 64th Street. The building is undergoing a thorough course of repair, and many improvements will be made which will be conducive to the comfort and convenience of both exhibitors and visitors. It is the intention of the management to make the fair, if possible, more popular than that of last year, which was the most successful ever held.

Judging from present indications, there is every reason to believe that the coming exhibition will be more than usually attractive, instructive and interesting, for a larger number of applications for space have been received this year, up to date, than has previously been the case, and among these are promised many new and effective novelties in the various departments into which the exhibits are divided. These divisions are seven in number, and are "Fine Arts and Education, the Dwelling, Dress and Handicraft, Chemistry and Mineralogy, Machinery, Inter-communication; and Agriculture and Horticulture." These departments, it may be mentioned, are subdivided into seven groups each, each group having three judges, who examine all the articles on exhibition, and make a report thereon to the Board of Managers, recommending such awards as they may adjudge due, and upon these reports the managers act.

Manufacturers, designers, inventors and others desirous of placing their products before the public at the coming fair should, without delay, send on their applications for space to Mr. Charles Wager Hull, the general superintendent, at the office of the Institute, 22 Cooper Union, New York, as "first come, first served" is the motto that rules. And it should also be borne in mind that early entries greatly facilitate classification, and, as a general thing, secure the intending exhibitor more ample and suitable space and location than might otherwise be the case.

In this connection, it will, perhaps, be interesting to many to know the conditions under which the awards are made. They are as follows: The medal of honor (gold) is awarded only for an article or process which shall show a marked improvement on those previously in use, and be considered of the highest importance in science or the arts. It is awarded on the recommendation of three judges, approved by a majority of the Board of Managers, and confirmed by a majority of the Board of Trustees.

The special medal (silver) is awarded only for an article of great importance and extraordinary merit. This medal may be offered for a certain number of exhibits in each year, a list of which shall be prepared by the Board of Managers.

The medal of taste (silver) is awarded for any article or process which is considered of unusual excellence in the first four groups of the Department of Fine Arts and Education.

The medal of superiority (bronze) is awarded for an article or process of great value. The medal of excellence (bronze) for article or processes of importance, and the medal of merit (bronze) for articles or process of acknowledged merit.

In addition to these, diplomas are granted to employes who, by their skill, add to the attractiveness of the exhibition, and awards are made for the best skill and workmanship by apprentices. Awards are also made to exhibitors of perishable products in money or other valuable consideration.

The entrance fee to exhibitors is the same as in former years, viz., $10, but there is no charge made for space. The entrance fee also gives the exhibitor the right of admission to the building for himself and employe.

Railroad Facilities for Schools and Colleges Visiting the Exhibition.

The Pennsylvania and the Philadelphia & Reading Railroads have made the following rates on their main lines and connections for excursion tickets to the Electrical Exhibition: For parties of not less than thirty going and returning in a body on one ticket, one cent per mile for the distance traveled. Going in a body and returning singly, one fare for the round trip, the tickets to be limited as follows: One hundred miles or less, three days; between 100 and 200 miles, four days; over 200 miles, five days.

To obtain these rates it will be necessary for the principal of the school to make application, either direct, or preferably through the ticket agent at the point where the school is located, addressed, in case of stations on the Pennsylvania Railroad or its connections, to J. R. Wood, General Passenger Agent, and in case of stations on the Philadelphia & Reading Railroad or its connections, to C. G. Hancock, General Passenger Agent, giving the number of persons who will attend, whether they will return in a body or separately, and the dates on which tickets will be used, going and returning, on receipt of which information proper orders will be issued for the sale of tickets.

The charges for admission to the Exhibition has been fixed at fifty (50) cents, children under twelve years twenty-five (25) cents. To facilitate the attendance of schools and to meet the very liberal rates offered by the railroad companies, the rate of admission for schools, attending in a body of not less than thirty, has been fixed at twenty-five (25) cents per scholar, regardless of age. One teacher to each fifteen scholars being admitted free.

For schools within the territory covered by the roads centering at Philadelphia, arrangements for transportation have been made as set forth above. We have received applications from colleges at various points outside that territory from Massachusetts to Missouri, asking for rates of transportation.

To these we can only reply that such organizations must make application to the general passenger agent of the road on which they are situated, stating the number of persons who will make up their party and the time for which they wish their tickets to run, bearing in mind that the larger the party the better the prospect for a reduction of fare.

Upon such application the best arrangement practicable will be made for them, but for business reasons satisfactory to the railroad companies these arrangements cannot be made from this end of the line. As the necessary correspondence will take some time, the sooner the application is made the better.

Electrical Exhibition Examiners — The Sections as Organized by the Executive Committee of the Board.

A report has been agreed upon by the Executive Committee of the Board of Examiners of the International Electrical Exhibition, in the matter of the committees or sections to whom will be referred the merits of the different exhibits coming under their special supervision. The arrangement, which is subject to modification by the committees themselves, is as follows:

1. Dynamo-Electric Machines for Lighting—M. B. Snyder, chairman; Carl Hering, secretary; William A. Anthony, F. A. P. Barnard, C. F. Brackett, Henry S. Carhart, Charles R. Cress, Louis Duncan, Moses G. Farmer, Bradley A. Fiske, William E. Geyer, William H. Greene, William H. Harding, N. S. Keith, A. L. Kimball, J. Hays Linville, William D. Marks, T. C. Mendenhall, John Milliss, Joseph B. Murdock, Simon Newcomb, F. C. Nipher, E. C. Pickering, S. M. Pinsh, Frank L. Pope, H. W. Spangler, B. F. Thomas, F. C. Van Dyck, William H. Wahl, G. H. Mead, J. Burkitt Webb, A. B. Wyckoff, Charles A. Young.

II. Dynamo-Electric Machines for Plating—C. F. Brackett, chairman; B. F. Thomas, secretary; membership same as above.

III. Dynamo-Electro Machines for Miscellaneous Purposes—Joseph B. Murdock, chairman; J. Burkitt Webb, secretary; membership the same.

IV. Dynamo-Electric Motors, for Transmission of Energy—Simon Newcomb, chairman; F. C. Nipher, secretary; membership the same.

V. Arc Lamps—William A. Anthony, chairman; N. S. Keith, secretary; Charles H. Banes, F. A. P. Barnard, C. F. Brackett, Pliny E. Chase, Charles R. Cross, Amos E. Dolbear, C. B. Dudley, Louis Duncan, Moses G. Farmer, Bradley A. Fiske, Persifer Frazer, Wm. E. Geyer, Wm. H. Greene, Wm. H. Harding, D. P. Heap, Carl Hering, A. L Kimball, J. Hays Linville, Wm. D. Marks, T. C. Mendenhall, O. E. Michaelis, John Milliss, Joseph B. Murdock, Simon Newcomb, F. C. Nipher, H. M. Paul, E. C. Pickering, Frank L. Pope, T. W. Rae, R. E. Rogers, William A. Rogers, Charles E. Ronaldson, S. P. Sadtler, H. W. Spangler, M. B. Synder, B. F. Thomas, F. C. Van Dyck, A. B. Wyckoff, Charles A. Young.

VI. Carbons for Arc Lamps—S. P. Sadtler, chairman; C. B. Dudley, Secretary. Membership the same.

VII. Incandescent Lamps—Chas. R. Cross, chairman; A. L. Kimball, secretary. Membership the same.

VIII. Photometric Measurements—E. C. Pickering, chairman; C. F. Brackett, secretary. Membership the same, with the exception of Messrs. Mendenhall and Pope.

IX. Dynamo-metrical Measurements—H. W. Spangler, chairman; Gaetano Lanza, secretary; A. V. Abbott, F. A. P. Barnard, Gould H. Bull, C. Chabot, Pliny E. Chase, Charles L. Clarke, R. E. Crawford, J. E. Denton, Charles H. Fisher, Carl Hering, W. Barnet Le Van, William Ludlow, William D. Marks, M. Merriman, John Milliss, Jos. B. Murdock, E. C. Pickering, T. W. Rae, R. E. Rogers, M. B. Snyder, Wm. P. Tatham.

X. Boilers—T. W. Rae, chairman; Otto C. Wolf, secretary; Luigi D'Auria, Gould H. Bull, C. Chabot, R E. Crawford, Charles H. Fisher, Frederick Graeff, Carl Hering, Washington Jones, Gaetano Lanza, W. Barnet Le Van, William Ludlow, William D. Marks, O. E. Michaelis, John Nystrom, Charles E. Ronaldson, H. W. Spangler, A. B. Wyckoff.

XI. Steam Engines—William D. Marks, chairman; H. W. Spangler, secretary; F. A. P. Barnard, George H. Barrus, Gould H. Bull, George L. Clarke, R. E. Crawford, Charles H. Fisher, Frederick Graeff, Carl Hering, Washington Jones, Gaetano Lanza, W. Barnet Le Van, William Ludlow, M. Merriman, T. W. Rae, Charles E. Ronaldson, M. B. Snyder, J. Burkitt Webb, Otto C. Wolf, A. B. Wyckoff.

XII. Gas Engines and other Prime Motors—J. Burkitt Webb, chairman; Luigi D'Auria, secretary; A. V. Abbott, George H. Barrus, Hugo Bilgram, Cyrus Chambers, Jr., Luther L. Cheney, Chas. M. Cresson, J. E. Denton, Charles H. Fisher, Washington Jones, W. Barnet Le Van, Wm. D. Marks, T. W. Rae, H. W. Spangler, S. Lloyd Wiegand.

XIII. Apparatus for High Electro-motive Force—1, Lightning protection; 2, Electrostatic induction machines and induction coils; 3, Igniters—A. L. Kimball, chairman; A. E. Outerbridge, secretary; William A. Anthony, John B. De Motte, Amos E. Dolbear, Wm. Drysdale, Persifer Frazer, W. A. Harding, T. C. Mendenhall, Joseph B. Murdock, F. C. Nipher, Theodore D. Rand, D. R. Walker.

XIV. Voltaic-electro Apparatus. 1, Voltaic batteries and accessories; 2, Polarization and storage batteries—F. C. Van Dyck, chairman; William H. Greene, secretary; David Brooks, Charles Bullock, Henry S. Carhart, Amos E. Dolbear, William Drysdale, C. B. Dudley, Moses G. Farmer, Walker M. James, Jos. B. Murdock, C. B. Penrose, W. J. Phillips, S. B. Sadtler, Louis H. Spellier, William H. Wahl, D. R. Walker, Lewis S. Ware.

XV. Electro-metallurgy—Henry Morton, chairman; William H. Wahl, secretary; C. F. Brackett, Charles Bullock, W. H. Greene,

N. S. Keith, A. E. Outerbridge, S. P. Sadtler, Samuel Sartain, Wm. P. Tatham, Lewis S. Ware.

XVI. Thermo and Magneto-electric Apparatus—S. P. Langley, chairman; William A. Anthony, secretary; C. F. Brackett, Henry S. Carhart, Amos E. Dolbear, William H. Harkness, William Ludlow, F. C. Nipher, C. E. Penrose, B. F. Thomas, Charles A. Young.

XVII. Electric Conductors—1, Telegraph and Telephone Wires and Cables; 2, Electric Light and Power Circuits; 3, Submarine Cables—B. F. Thomas, chairman; A. L. Kimball, secretary; Charles R. Cross, C. B. Dudley, Moses G. Farmer, William E. Geyer, W. H. Harding, F. C. Nipher, Frank L. Pope, T. W. Rae, D. R. Walker.

XVIII. Underground Conduits—Charles H. Banes, chairman; Wm. E. Geyer, secretary; C. B. Dudley, Persifer Frazer, Henry Morton, Joseph B. Murdock, Frank L. Pope, T. W. Rae, Samuel L. Smedley, F. C. Van Dyck, D. R. Walker, C. E. Wead, Charles A. Young.

XIX. Electric Telegraphs—1, Morse Systems; 2. Printing Telegraph; 3, Duplex, Quadruplex, Multiplex and Harmonic Systems—Frank L. Pope, chairman; Amos E. Dolbear, secretary; James Allen, Hugo Bilgram, David Brooks, Charles R. Cross, John B. De Motte, Daniel Draper, Moses G. Farmer, Mark W. Harrington, N. S. Keith, John Milliss, John Nystrom, H. M. Paul, William A. Rogers, E. Alexander Scott, Horace W. Sellers, Charles J. Shain.

XX. Telephones, Microphones and Radiophones—Charles A. Young, chairman; C. E. Wead, secretary, W. A Anthony, H. S. Carhart, Hugh Archibald Clarke, John B. De Motte, W. H. Harding, D. P. Heap, A. L. Kimball, C. J. Kintner, S. P. Largley, Henry Morton, F. C. Nipher, Frank L. Pope, William A. Rogers, E. Alexander Scott, Charles J. Shain, Leonard Waldo, R. R. Walker.

XXI. Fire and Burglar Alarms and Annunciotors—D. R. Walker, chairman; E. Alexander Scott, secretary; Hugo Bilgram, David Brooks, Wm. Drysdale, D. P. Head, Emanuel Hildelbrandt, H. M. Paul, Frank L. Pope, Theodore D. Rand, Charles J. Shain, Louis H. Spellier, P. H. Van Der Weyde.

XXII. Electro-signal and Registering Apparatus — William A. Rogers, chairman; Mark W. Harrington, secretary; James Allen, Charles R Cross, Amos E. Dolbear, Daniel Draper, Bradley A. Fiske, W. H. Harding, W. H. Harkness, D. P. Head, C. J. Kintner, H. M. Paul, C. B. Penrose, E. C. Pickering, S. M. Plush, Frank L. Pope, R. E. Rogers, F. C. Van Dyck, Leonard Waldo.

XXIII. Electro-therapeutic Apparatus—Harrison Allen, chairman; Robert J. Bartholow, secretary; C. F. Brackett, Charles M. Cresson, Wm. Drysdale, J. Foster Flagg, James H. Lloyd, Charles K. Mills, Isaac Norris, Louis H. Spellier, P. H. Van der Weyde, Horatio C. Wood.

XXIV. Electro-dental Apparatus—J. Foster Flagg, chairman; Wm. Drysdale, secretary; Robert J. Bartholow, Cyrus Chambers, Jr., Walker M. James, James H. Lloyd, Charles K. Millis, Samuel Sartain, Carl Seiler, Horatio C. Wood.

XXV. Applications of Electricity to Musical Apparatus—Hugh Archibald Clarke, chairman; Leonard Waldo, secretary; Amos E. Dolbear, H. M. Paul, Carl Seiler, Samuel L. Smedley, S. L. Weigand.

XXVI. Applications of Electricity to Artistic Effects and Art Productions—Frederick Graeff, chairman; O. E, Michaelis, secretary; David Brooks, Charles M. Cresson, G. Morgan Eldridge, Emanuel Hildebradt, Samuel Sartain, William P. Tatham.

XXVII. Application of Electricity to Warfare—D. P. Heap, chairman; Louis Duncan, secretary; David Brooks, Bradley A. Fiske, W. H. Greene, John Milliss, R. E. Michaelis, Joseph P. Murdock, A. O. Outerbridge, T. W. Rae, Horace W. Sellers, B. F. Thomas, A. B. Wyckoff.

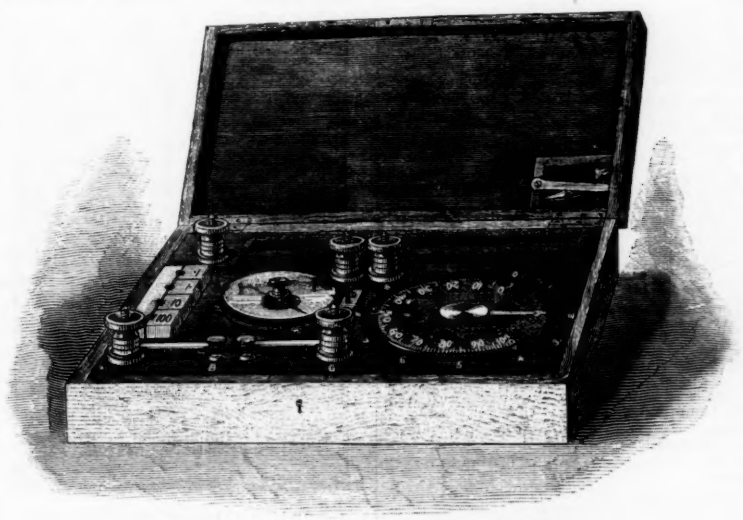
XXVIII. Instruments of Precision—Henry S. Carhart, chairman; M. B. Snyder, secretary; W. A. Anthony, F. A. P. Barnard, C. F. Brackett, Charles R. Cross, Amos E. Dolbear, Daniel Draper, Louis Duncan, Moses G. Farmer, Persifer Frazer, Wm. E. Geyer, W. H. Harding, W. H. Harkness, Carl Hering, A. L. Kimball, T. C. Mendenhall, Henry Morten, Joseph B. Murdock, Simon Newcomb, F. C. Nipher, H. M. Paul, E. C. Pickering, Frank L. Pope, T. W. Rae, R E. Rogers, W. A. Rogers, B. F. Thomas, Leonard Waldo, J. Burkett Webb, Charles A. Young, Joseph Zentmayer.

XXIX. Educational Apparatus—William H. Harding, chairman; T. C. Mendenhall, secretary; Harrison Allen, W. A. Anthony, H. S. Carhart, A. E. Dolbear, G. M. Eldridge, Persifer Frazer, Gaentano Lanza, F. C. Nipher, Isaac Norris, E. C. Pickering, R. E. Rogers, C. E. Wead, J. Burkitt, Charles A. Young, Joseph Zentmayer.

Blackburn's Portable Testing Apparatus.

We are indebted to the London *Electrical Review* for the following description and cuts of above apparatus, which some of our readers have expressed a desire to see :

Electric light engineers often have occasion to ascertain the resistances of the machines and circuits with which they have to deal, under conditions which make it inconvenient to have at hand the comparatively cumbrous apparatus which is usually provided for the purpose. The instrument of which we this week give an illustration has been designed with a view to portability, and to enable it to be used without much time being lost in setting it up. It is made by Messrs. Latimer, Clark, Muirhead & Co., and although the last and improved pattern is somewhat larger than that originally introduced, it is still of so small a size that electricians can easily carry it with them. The range and sensitiveness of the instrument are amply sufficient, and it is further capable of forming a useful adjunct to more delicate apparatus in the laboratory, seeing that it is always set up ready for instant use, and that measurements can be made with great rapidity. To combine, in such small compass, so many different parts in a practical form, and to ensure correct reading with the minimum of skill on the part of the operator, necessarily required some little evolution, yet the result has been obtained by taking advantage of known methods without embodying any new principle.



BLACKBURN'S PORTABLE TESTING APPARATUS.

"Chloride of silver elements, wrapped in blotting-paper moistened with a solution of zinc chloride, supply the current. The galvanometer needle is astatic, suspended from a torsion head by a silk fiber, and can be set to zero without it being necessary to adjust the position of the instrument relatively to the magnetic meridian.

"A single plug, which, when not in use, is placed in the cover as shown, serves to vary the comparison coils from 0.1 to 100 ohms. A battery and galvanometer key prevent the extra current due to induction disturbing the balance.

"The arrangement of branch coils whilst, as in the ordinary "meter" bridge, permitting of continuous variation in values being read, provides a length of wire the resistance of which bears a due proportion to the other resistances in circuit. The principle is derived from Messrs. Thomson and Varley's well-known slide resistance box. Eleven coils, with contact pieces, are arranged in series in the base beneath the turn-table, this latter carrying two contacts, which serve to embrace two of these coils; a wire having double the resistance of a single coil is stretched round the edge of the table and joins the two contacts, being for final adjustment capable of sub-division at any point by the index-arm which carries the battery current. When used for taking resistances, the connections are made to the two terminals. The table is then set with the arrow pointing to such a number as on trial gives the smallest deflection of the needle, a final adjustment being obtained by moving the index-arm. The number pointed to by the arrow is then read off as hundreds, that indicated on the table itself as tens and units. The instrument, as we ourselves have observed, gives fairly correct readings from 0.005 to 2000 ohms, but will give approximate readings of a much higher value.

"Two terminals are also provided for the insertion of extra battery power, should it be desired to take insulation tests with a higher E. M. F. It would also be possible to measure the sectional resistance of shells by Mance's method, by taking out the ordinary cells, bridging over the two battery terminals, connecting the cell to be measured at *X* and *B*, and adjusting the galvanometer either by the torsion head or by an external magnet.

"Lastly, the instrument can be used as a simple detector by joining up to *B* and *C*, and using the left-hand key.

"In making a concluding remark on Mr. Blackburn's very ingenious and highly useful apparatus, we would suggest that the containing case should be made somewhat deeper. We do not feel sure but that, as at present constructed, the coils, from the small and cramped space allotted to them, would not, sooner or later, get out of order.

"The contact of the rotating arm of the turn-table should also have careful attention, as a source of error might here be easily introduced.

"The apparatus only requires to be known to be much appreciated for its portability, ease of manipulation, and the variety of its uses."

ELECTRIC LIGHT NEWS

—— The Brush direct-running incandescent dynamo is giving general satisfaction.

—— It is stated that the Brush Electric Company have secured the contract to light the entire city of Detroit, Mich. They have now a large number of their arc lights in operation there.

—— The Brush Electric Light Company, of Cleveland, are putting in 275 Swan incandescent lamps to light the New Albany Woolen Mills, New Albany, Indiana, to be run from a Brush dynamo. The New Albany Woolen Mills is the largest mill west of Philadelphia.

——Portland, Oregon, will shortly be lit by electricity. The initiatory plant consists of three 50-light U. S. dynamos, driven independently by three Westinghouse automatic engines of 65 horse-power each, which will, on occasion, each drive an additional 20-light dynamo. The boilers are on the ground floor, the engines on the second, and the dynamos on the third floor.

—— The Brush Electric Light Company, of Boston, has been in operation now about three years. They are operating two stations in this city; one is situated at No. 5 Lancaster street, and the other is at Mayo's Block, near Dover street, at South End. They have decided to concentrate their business, and will build a new station on Ferdinand street, near the Providence railroad station. They will commence at once to erect a large building for dynamo-electric machines, boilers and engines, and will lay out for a capacity of 1,000 electric lights. They closed a contract last week with the Jarvis Engineering Company of this city for five 150 horse-power Armington & Sims engines. The new station of the Brush Company will be a model one, and will contain all the modern improvements in the way of economy in making steam.

—— Messrs. William Harvie & Company, Glasgow, have just completed an extensive and very interesting electric light installation on the paddle steamer Saturno. The dynamo used for the production of the current is the Elphinstone-Vincent machine. It is capable of supplying sufficient current for 400 Swan incandescent 20-candle power lamps, and the installation includes 320 such lamps, which are arranged in such a manner as to insure that the lighting shall be equally brilliant all over the principal parts of the ship. They are distributed in six main sections, and the main switchboard, which is placed in the engine room, and from which they are all controlled, has six double-contact switches. The lamp-holder or socket is one that was recently devised and patented by Mr. William Harvie, the contractor for the installation, and although involving a little trouble in changing a lamp, it makes an excellent contact.

—— Dr. W. H. Stone, F. R. S., who recently read a paper on the physiological bearing of electricity on health, at the International Health Exhibition, on the occasion of the conference held there by the Society of Telegraph Engineers and Electricians, has devised a pair of spectacles or eye protectors for persons who are in the habit of working by or with electric light. The spectacles are made by Mr. Baker, of High Holborn, and consist of front glasses of blue with attached side glasses or "blinkers" of red glass. The danger to the eye from the incandescent lamp is likely to arise from the red or heat rays, that from the arc lamp is due to excess of blue or actinic rays, hence the use of two glasses. In looking at the incandescent light through the blue glasses, the glare is removed and irritation from the intense yellow and red rays prevented, while after folding down the red side glasses over the blue front ones, the arc light can be looked at with safety through the joint media. The tints of the glasses are selected and combined by help of the spectroscope.

—— The electric light has been introduced into Craig-y-Nos Castle, the Welsh residence of Madame Adelina Patti. The installation consists of seventy 20-candle power incandescent lamps, distributed in the winter garden, conservatory, dining hall, drawing room, billiard room, boudoir, etc. In the winter garden and conservatory the lamps hang by twisted silk cord from the roof, and have tinted green lilies over them. The effect amongst the various climbing and other plants which are festooned about the roof is charming. In the dining, drawing, and billiard rooms and the boudoir the lamps are partly attached to the existing gas fittings, and partly hung by silk cords from the ceilings. The lamps are all covered by tinted opalescent ruby and other shades.

ELECTRICAL PATENTS

INDEX OF INVENTIONS FOR WHICH LETTERS PATENT OF THE UNITED STATES WERE GRANTED IN THE WEEK ENDING AUGUST 26, 1884.

304,007 Unison apparatus for printing telegraphs; A. A. Knudson, Brooklyn, N. Y., assignor to the Western Union Telegraph Company, of New York, N. Y.

304,020 Composition for covering and insulating electric wires; Charles G. Muskat, Milwaukee, Wis.

304,025 Means for rotating the type wheels of printing telegraphs; George M. Phelps, Brooklyn, assignor to Western Union Telegraph Company, of New York.

304,037 Transmitter for printing telegraphs; Geo. B. Scott, Brooklyn, N. Y.

304,051 Unison apparatus for printing telegraphs; William B. Vansize, Brooklyn, assignor to the Western Union Telegraph Company, of New York.

304,052 Printing telegraph; William B. Vansize Brooklyn, and Charles L. Buckingham, New York, assignors to the Western Union Telegraph Company, New York.

304,059 Telegraphic transmitter; Rufus Anderson, Peekskill, N. Y.

304,082 Electrical meter; Thos. A. Edison, Menlo Park, N. J., assignor to the Edison Electric Light Company, New York, N. Y.

304,083 Dynamo-electric machine; Thomas A. Edison, Menlo Park, N. J.

304,084 Device for protecting electric lighting systems from lightning; Thomas A. Edison, Menlo Park, N. J.

304,085 System of electrical distribution; Thomas A. Edison, Menlo Park, N. J.

304,086 Incandescent electric lamp; Thomas A. Edison, Menlo Park, N. J.

304,087 Electrical conductor; Thomas A. Edison, Menlo Park, N. J.

304,106 Means for overcoming static troubles in telegraphs; Francis W. Jones, New York, N. Y.

304,121 Magneto-electric signaling attachment for telephones; August J. W. Munch, Berlin, Germany.

304,135 Telephone switchboard; Paul J. Rousseau, Detroit, Mich.

304,145 Dynamo-electric machine; Frank J. Sprague, United States Navy.

304,170 Electric conductor; Francis D. Cady, Washington, D. C.

304,209 Electrical signaling apparatus; James V. Mackenzie, New York, N. Y.

304,265 Electric battery jar and method of insulating the same; Isham D. Fuller, Atlanta, Ga., assignor of one-half to Green J. Foreacre, Newark, Ohio

A printed copy of the specification and drawing of any patent to the annexed list, also of any patent issued since 1865, will be furnished by any of the patent solicitors whose advertisements appear in this journal. In ordering please state the number and date of the patent desired.

If an invention has not been patented in the United States for more than one year, it may still be patented in Canada. Cost for Canadian patent, $40.00. Various other Foreign patents may also be obtained.

HELLO!

BOWEN'S NEW

Universal Telephone

FOR PRIVATE BUSINESS LINES.

Transmits speech in the CLEAREST NATURAL tone of any mechanical telephone ever offered.
The most practical and durable telephone for all independent lines. Contains latest improvements. Superior to others now in use. Business can be transacted through the line when the wind blows hard. Is self-contained, and has Magneto Call Bells, Lightning Arrester, Cut-out Switch, etc. Requires no battery. Placed in handsome walnut cases with nickel trimmings. Unequaled for connecting general offices with different departments, freight depots, etc.; also for factories, shops, lumber and coal yards, offices to residences, mills, furnaces, coal mines, etc. *Sold outright at reasonable prices.*
Circulars free. Mention this paper.

WM. J. BOWEN,

Manufacturer and Sole Proprietor,

NORWALK, OHIO.

Edward P. Thompson, M. E.,

MEMBER, AMER. SO., M. E. and AMER. INST. ELECT. E.

As EXPERT in the courts, solicits chemical and electric light and power cases and no others. Send for references and Terms per hour.

As PATENT ATTORNEY, assists the inventor to determine the practicability and patentability of each mechanical and chemical invention, before any expense is incurred. Send for circular of fees, which are very reasonable.

13 PARK ROW, NEW YORK.

BUSINESS NOTICES.

A. C. NORTHROP, Waterbury, Conn. Iron and Brass Machine Screws, Zinc in Sheets and Plate for Electrical Purposes, Parts for Telephone and Telegraph Instruments, Manufactured from Iron, Brass, Steel or Zinc.

A. G. DAY, Kerite Insulated Telegraph and Telephone Wire and Cables, Anti-induction Kerite Telephone Cables, CLARKE B. HOTCHKISS, New York. Send for circular and prices.

ALFRED F. MOORE, Philadelphia, Pa. Telegraph, Telephone, Electric Light, Office, Line and Annunciator Wire.

AMERICAN BELL TELEPHONE Co., Boston, Mass. Electric Speaking Telephones for Exchange Systems, Private Lines, and Speaking-tube Lines.

AMERICAN ELECTRICAL WORKS, Providence, R. I. Patent Finished Insulated Electric Wires, Telephone and Electric Cordage. Electric Light Wire, Magnet Wire, Patent Rubber covered Wire, Aerial and Underground Cables, &c., &c. Send for prices.

AMERICAN INSULATOR COMPANY, New York. Insulators of all sizes.

AMERICAN SPIRAL TELEPHONE WIRE Co., Boston, Mass. Spiral Telephone Wire for long and short distance Telephoning. Write for information.

ARMINGTON & SIMS, Providence, R. I. Engines for Electric Lighting and general use.

AUSTIN GALLAGHER, New York. Keith Electric Light System complete for Arc Lighting. Stock for sale.

BAXTER ELECTRIC LIGHT COMPANY, New York. The Baxter Lamp.

A. M. YOUNG, Waterbury, Conn., Leclanche Zincs. Old style of rod with new connection.

B. W. PAYNE & SONS, Corning, N. Y. The Payne Single and Double Valve Automatic Engine. Send for catalogue.

BERGMAN & Co., New York. The Bergman and Haid Battery for Telephone and Telegraph purposes. Send for circular.

BOULTON CARBON Co., Cleveland, Ohio. Carbons for Electric Light purposes. Send for quotations.

BROWNLEE & Co., Detroit, Mich. Telegraph and Telephone Poles.

BRUSH ELECTRIC Co., Cleveland, Ohio. Arc Lights and Brush Storage Batteries.

BUFFALO ELECTRIC WORKS, Buffalo, N. Y. Carbon Points and Plates.

BUTLER HARD RUBBER COMPANY, New York. Rubber Insulators and Electrical Supplies of every description.

C. H. MOORE & Co., Washington, D. C. Solicitors of American and Foreign Patents.

C. P. WHITNEY, New York. General Eastern Agent of the Detroit Iron Tower Company. Towers and Arches, for Park and Street Lighting.

CHARLES WILLIAMS, JR., Boston, Mass. Call Bells, Electric Bells, District Bells, Switch Boards, Annunciators, &c., &c. Write for quotations.

CHROME STEEL WORKS, Brooklyn, N. Y. Steel for Magnets a specialty; Chrome Cast Steel.

COE BRASS Co., Torrington, Conn. Brass, Copper and German Silver in every variety of Sheets, Rolls, Plates, Wire, Rods and Blanks or Shells. Pure Lake Superior Copper Wire and Battery Zincs. Write for price list.

CONNOLLY BROTHERS, New York, Patent Attorneys and Solicitors.

CORNELL UNIVERSITY, Ithaca, N. Y. Electrical Engineering.

DETROIT ELECTRIC COMPANY, Detroit, Mich., white oak Pins and Brackets.

D. VAN NOSTRAND, New York. Scientific Books. Send for circular.

F. E. KINSMAN & Co., New York. Imported and Experimental Apparatus, Geisler Tubes, Motors, Coils, Lanterns, etc.

HARVEY, STAFFORD & Co., Acton, Ont., Canada Telegraph and Telephone Poles.

H. M. RAYNOR, New York. Platinum for all purposes.

HOLMES, BOOTH & HAYDENS, New York. Fireproof Electric Light Wire, Patent "KK" Insulated Copper and Iron Wire for Telephone and Telegraph use. Send for catalogue and prices.

I. W. COLBURN & Co., Fitchburg, Mass. Dynamo Electric Machines.

J. O. SHIRAS, Cincinnati, O. Telephone Stocks bought and sold.

JARVIS ENGINEERING COMPANY, Boston, Mass. Boilers set with the Jarvis Patent Furnace.

LECLANCHE BATTERY COMPANY, New York. The Great Telephone Battery. Write for description and prices.

J. H. BUNNELL & Co., New York. The Morse Learner's Instrument, Telegraph Instruments of all kinds, Telephone and Telegraph Supplies. Illustrated Works on Electrical Measurement, and the Galvanometer and its uses. Send for catalogue.

LAW TELEGRAPH Co., New York. The Law Battery for Telephone and Telegraph purposes.

MITCHELL, VANCE & Co., New York, manufacturers of Electroliers and Combination Fixtures, for both gas and electric light.

MONARCH ELECTRIC COMPANY, New York. Electric Motors, Dynamo Machines, etc.

NATIONAL ELECTRIC COMPANY, Washington, D. C. Electrical supplies and apparatus.

NEW ENGLAND BUTT COMPANY, Providence, R. I. Braiding Machinery for covering Telegraph, Telephone and Electric Light Wire, Single and Double Winders and Braiders of every description; also Fine Castings. Send for catalogue.

O. W. MADDAUS, New York. Designer and Engraver.

PAINE & LADD, Washington, D. C. Attorneys in Patent Causes, and Solicitors of Patents.

PALMER WIRE Co., Palmer, Mass., and New York. Galvanized Telephone and Telegraph Wire Iron and Steel Wire of best quality, Material, finish and conductivity. Write for quotations.

PARTRICK & CARTER, Philadelphia, Pa. Electric Annunciators, Learners' Instruments, Batteries and Telegraph and Telephone Supplies. Write for circulars.

PHOSPHOR BRONZE SMELTING Co., Philadelphia, Pa. Telephone Wire, insulated and bare.

ROYCE & MAREAN, Washington, D. C. Dealers in Electrical apparatus, Telegraph and Telephone supplies.

RHODE ISLAND TELEPHONE & ELECTRIC Co., Providence, R. I. Manufacturers of the Providence Telephone Switch Boards, Breckenridge Jacks, Wright Cable Clips, Howard Safety Appliances, &c.

SCHLEICHER, SCHUMM & Co., Philadelphia, Pa. Manufacturers of the Otto Gas Engine. Write for catalogue.

LAURENCE & HERKNER, New York. Manufacturers of Leather Belting for Electric Lighting. Send for catalogue.

CLARK INSULATED WIRE COMPANY, Philadelphia, Pa. Rubber and Braided Wire, for telegraph, telephone, and electric light use.

THE FREEMAN & ROE ELECTRICAL SUPPLY COMPANY, New York. Electric Light Machines, Motors, Dynamos, Telegraph and Telephone Apparatus.

SWAN INCANDESCENT ELECTRIC LIGHT Co., New York. Incandescent Lights, and Complete Apparatus. Send for illustrated catalogue.

THE ANSONIA BRASS AND COPPER Co., New York Pure Electric Copper Wire for Magnets, Telephone Lines, and Electric Light purposes, Office Wire, Zinc Rods and Battery Copper.

THE BISHOP GUTTA PERCHA WORKS, New York, Gutta Percha Insulated Submarine Telegraph Cable Subterranean Telegraph Cables, Aerial Telegraph Cables, Lead or Hempen covered Torpedo Cables, Lead-covered Cables, Telephone Cables of all kinds —G. P. Office Wire, and Marks' Compound Insulated Wire, &c., &c. Send for catalogue.

THE BUTLER HARD RUBBER COMPANY, New York. Electrical supplies, Rubber Hook Insulators, Hardwood Tubes, Plug Handles, Lamp Switch Handles, Battery Syringes, etc.

T. H. ALEXANDER, Washington, D. C., Solicitor and Counselor in Patent cases.

THOMSON-HOUSTON ELECTRIC Co., Boston, Mass. Automatic Self-regulating System of Arc Lighting.

THE ELECTRICAL SUPPLY Co., New York. Electric Light, Telephone and Telegraph Supplies. Send for price list and catalogue

TRENTON IRON Co., Trenton, New Jersey. Galvanized Iron and Steel Wire of all kinds for Telephone and Telegraph purposes. Write for prices.

UNITED STATES ELECTRIC LIGHT Co., New York. Arc and Incandescent Lights, complete and reliable systems, &c. Write for information.

VIADUCT MANUFACTURING COMPANY, Baltimore, Md. Electrical Goods of every description. Electric Light and American District supplies. Send for price-list.

VICTOR, BISHOP & Co., New York. Platinum for all Manufacturing, Chemical and Electrical purposes. Send for prices.

W. B. EARTHMAN & Co., Murfreesboro, Tenn., Red Cedar Poles. Write for prices.

WESTERN ELECTRIC Co., New York, Boston, and Chicago. Telegraph and Telephone Apparatus and Supplies of every description. Send for catalogue.

WM. A. HARRIS, Providence, R. I. The Harris-Corliss Steam Engines and Light and Heavy Castings.

W. R. POPE & Co., Baltimore, Md. Telegraph, Telephone, and Electric Light supplies. The best of everything, and at lowest prices.

WILLIAM KLINE, Toledo, O. Patent Portable and Adjustable Cross-Arm Holder.

DETROIT IRON TOWER CO.

Towers AND Arches

FOR PARK AND STREET LIGHTING.

The sure means by which Illuminating is done better and cheaper than by gas.

One tower will supersede several hundred gas lights, by the use of three to six 2000 candle power lights at 125 to 175 feet high. Of the many in use, not one has failed to give satisfaction, nor have they been injured by the fiercest storms.

They are of many styles and highly ornamental as well as cheap.

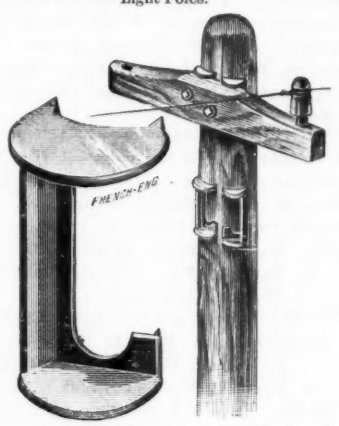
C. P. WHITNEY, GENERAL Eastern Agent.

853 BROADWAY, N. Y.

PATENT PORTABLE AND ADJUSTABLE

CROSS ARM HOLDER

Especially adapted for Telephone and Electric Light Poles.



Among the many advantages in using the Cross Arm Holder are the following:
It does away with cutting gains in poles, as is done at present; and thereby weakening the wood.
It gives a larger bearing to the cross arm. On a six inch pole it gives fully eight inches, and greater bearings on poles of larger dimensions.
It is easily adapted to standing poles.
It prevents decay to the poles and cross arms at the gain.
A cross arm with this holder is easily raised or lowered upon the pole without disconnecting wires from the insulator by merely withdrawing the screws
It will hold an arm of any length without other support.
For information and circulars, apply to

WM. KLINE, Supt. Teleg.

TOLEDO, O.

WANTED.

A bright young Telephone Inspector for South America. One that can speak Spanish preferred. State age and salary expected in the start. Must give Bond.

Address SOUTH AMERICA,
Care of Electrical Review.

Situation Wanted.

Young man, somewhat versed in electrical matters, and now securing scientific education evenings, desires position with electrical manufacturing or telephone company, highest references.

Address, WORKER,
Electrical Review.

WANTED.

Engineer who thoroughly understands erecting and running arc light plants and who can set boilers, engines, etc. Only those need apply who have made numerous installations. Apply by letter only to ASOR,

Care of Electrical Review.

CONNOLLY BROS.,

Patent Attorneys

AND SOLICITORS,

MORSE BUILDING,

Cor. Nassau & Beekman Streets,

NEW YORK.

PHILADELPHIA, PA.,

Mutual Life Insurance Building,

10th AND CHESTNUT STREETS.

WASHINGTON, D. C.

CORNER 6th and F STREETS.

ELECTRICAL CASES A SPECIALTY.

INTERNATIONAL ELECTRICAL EXHIBITION.

FRANKLIN INSTITUTE, PHILADELPHIA, PA.

1884. OPENS, SEPTEMPER 2nd. CLOSES, OCTOBER 11th 1884.